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# THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

Base Material for Dentures—*Furnas*
Tooth Structures and Caries—*Barker*
Inlay Casting Wax—*Taylor, Paffenbarger and Sweeney*
Impression Compound—*Taylor, Sweeney and Paffenbarger*
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EDITORIALS
1931—International Dental Congress

COUNCIL ON DENTAL THERAPEUTICS
Uses and Abuses of Barbitals

DENTAL HEALTH EDUCATION
Treatment of Cervices
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## Original Communications

# THE CHOICE OF A BASE MATERIAL FOR ARTIFICIAL DENTURES*

By I. LESTER FURNAS, D.D.S., Cleveland, Ohio

ONE hundred years ago, when the prosthetist constructed a denture for his patient, the choice of a base material was no problem. He either used wood or ivory, and from it, he carved his denture to the best of his ability. Today, conditions are quite different. Not only has the technic of denture construction vastly improved, but now we also find a wide choice of materials, each with its advantages and disadvantages, and indications and contraindications for its use.

The base of a denture may be defined as that portion of a denture which furnishes the support or attachment for the artificial teeth and rests on the oral tissues. In order that a base material may function properly, it must have certain definite characteristics and should have others:

1. It must resist all action of the secretions of the mouth, and must not be affected by foods taken into the mouth. 2. It must be odorless and tasteless. 3. It must not change its form under stress. 4. It must be dense and nonporous. 5. It should have the smallest possible amount of expansion or contraction. 6. It should be a good conductor of thermal changes. 7. It should inhibit, as far as possible, bacterial growth. 8. It must readily conform to a cast or die of the mouth. 9. It should harmonize in color with the tissues of the mouth. 10. It should have sufficient surface hardness to take and maintain a high polish.

All base materials do have these qualifications to a greater or less degree, depending on the material in question. Bases are divided into three general divisions: (1) plastic, (2) cast, and (3) swaged.

Plastic bases may be subdivided into all those vegetable or chemical substances

*Read before the Section on Full Dentures at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1930.

which are molded or pressed into a matrix and later "cured" or "fixed" in permanent form. These subdivisions of a plastic base are vulcanite, guttapercha, celluloid and the condensites or phenol resins. The second and third divisions, namely the cast bases and the swaged bases, are subdivided into the various metallic groups, such as gold, platinum, aluminum, palladium, silver, tin and their various combinations and alloys.

There are then the following materials available from which the prosthetist may make his choice for the construction of the base of the denture: (1) vulcanite, (2) guttapercha, (3) celluloid, (4) condensite or phenol resin, with the general commercial name of "bakelite," (5) tin and its alloys, (6) gold and gold alloys, (7) silver and its alloys, (8) platinum and its alloys, (9) palladium and palladium alloys, (10) aluminum and (11) stainless steel. There are many patented or trade names given to these materials and their combinations. These will not be considered separately.

### VULCANITE

Vulcanite is a compound of caoutchouc and sulphur. Caoutchouc is the dried milky juice (called latex) of various trees and plants found in the tropics. A similar gum capable of vulcanization can be obtained from the common milkweed, golden rod and other plants of the temperate climates. Caoutchouc is the native Indian name for the substance. The material found an early use in Europe as a means to remove black lead pencil marks from white paper. Its name, obviously, arose because it was a product of the Indies. Caoutchouc must have been known in America at a very early period, because balls made from the gum of a tree, lighter and bounding better than the "wind balls" of Castile, are mentioned by Herrera in speaking of the amusements of the natives of Haiti, in his account of the second voyage of Columbus. Many other authors of the fifteenth, sixteenth and seventeenth centuries not only mention this unusual gumlike material and its uses, but also give a description of the tree which is its source. While the Indians used it more than 300 years ago for water bottles and gum shoes, it was used in the United States and Europe only for erasing pencil marks until about 1820, when it was employed in the waterproofing of cloth. As this material became hard and brittle in cold weather and hot and sticky in hot weather, many experiments were made to overcome these objectionable qualities, which resulted in the discovery of vulcanite in January, 1839.

After the rubber trees are tapped, the juice (latex) is received in clay basins, and it is then solidified in various ways. One method is to spread it out in thin layers and evaporate it in the sun or by the aid of artificial heat. In recent years, much caoutchouc gum is produced from cultivated trees and is known as "plantation rubber." The cultivated gum is separated from the latex by acid, usually acetic or citric.

The organization and growth of the plantation rubber industry is a most fascinating study. The first statistics were available in 1900 when 53,890 tons of native or wild rubber were produced as compared to only 4 tons of plantation rubber; while, in 1920, we find the plantations put into the market 309,100 tons, and native rubber had fallen to 38,915 tons. At this period (1920), we find over 3,321,000 acres in rubber cultivation.

*Chemistry of Caoutchouc.*—When we consider from a purely chemical standpoint the "milk" from any one of the

various rubber-producing plants, the refined caoutchouc and the process of vulcanization, we find many problems that are yet to be solved by the chemist.

Latex is a milky fluid consisting of water in which is suspended minute globules of rubber. These globules are solid. When observed under the microscope, they seem to be somewhat irregular in shape. Since they are solid, we term latex as solid particles in suspension. If these globules were in the nature of a liquid, latex would be an emulsion.

The average chemical composition of latex is about as follows: chemically pure rubber, 28 per cent; resins, 2; mineral substances, from 0.3 to 0.7; proteins, from 1.0 to 2.0; sugars (dissolved in the water), from 1.1 to 2.3; water, about 60.

From latex may be obtained from 30 to 35 per cent of commercial raw rubber, which contains various numbers of these substances. A gallon of latex weighs 8.17 pounds and contains from 2.45 to 2.85 pounds of raw rubber.

Chemically pure rubber is a hydrocarbon with a formula of $C_5H_8$. There are several other hydrocarbons that show the same constituents on analysis. The rubber hydrocarbon is distinct. It is thought that several of these $C_5H_8$ groups are polymerized; hence, the composition is expressed thus $(C_5H_8)$?.

In studying a picture of the hydrocarbon and the exact relations of each element to the other, it is found that this material is classed with the terpenes $C_{10}H_{16}$; therefore, the formula for rubber is written $(C_{10}H_{16})$.

One can perhaps best think of rubber as a body made up of innumerable round globules of rubber in the form of a microscopic mass of fine shot, each of which is surrounded by a thin film of protective colloid, the protein substance. Thus, raw rubber is not like glass, which is homogenous; nor like leather, which is a mass of fibers; nor like wood, which is a mass of short, thick fibers forming a grain.

*Vulcanization.* — Vulcanization, ever since its discovery, has been one of the mystifying problems of the chemist. There are numerous theories advanced, each of which has its group of followers. One thing is definitely known, and that is that sulphur in some way actually combines with the rubber molecule. Rubber has a definite affinity for sulphur, and once they have become united, there is no known method of separation which will leave the two substances with the same physical properties as before the union. This union is thought by some to be chemical; by others, to be physical; while still a third group believe it to be a combination of the two.

At one time, it was believed that sulphur would not unite with rubber until the temperature had passed the fusing point of the sulphur, but this has been definitely disproved. Sulphur will unite with rubber at ordinary temperatures. In direct ratio as the temperature is increased, the time necessary for vulcanization is shortened. Time and temperature, therefore, become the two important and necessary outside factors giving the proper quality to the rubber composition.

There is another method of vulcanization known as the "cold" process. This is accomplished at ordinary temperatures by immersing pure caoutchouc in sulphur chlorid ($S_2Cl_2$). The results are essentially the same as in the "hot" process, but commercially impractical except in the manufacture of a few specialized articles, such as the dental rubber dam and surgeons' rubber gloves.

*Composition of Vulcanite for Artificial Dentures.*—As the formulas of the various makes of rubber are "trade secrets" of the manufacturers, our knowledge is

limited to the general specifications of patent papers and the writings which detail the experiments of Professor Wildman and others.

Both the soft pliable and the hard flexible vulcanite are used in the construction of dentures. The essential components of vulcanite are caoutchouc and sulphur, the ratio varying according to the use for which the product is designed. All other ingredients are for coloring or to cheapen the product. The soft pliable variety used in dentistry is known as velum rubber, because its most important use is for vela for cleft palates. It contains sulphur to the extent of about one-fifth of the weight of the gum. Hard vulcanite, sometimes called ebonite, contains by weight one-half as much sulphur as caoutchouc. The accompanying table presents some of the formulas given by Professor Wildman:

FORMULAS OF PROFESSOR WILDMAN

DARK BROWN

| | Parts | Per Cent |
|---|---|---|
| Caoutchouc | 48 | 66.6666 |
| Sulphur | 24 | 33.3333 |

RED

| | | |
|---|---|---|
| Caoutchouc | 48 | 44.4444 |
| Sulphur | 24 | 22.2222 |
| Vermilion | 36 | 33.3333 |

DARK PINK

| | | |
|---|---|---|
| Caoutchouc | 48 | 42.8571 |
| Sulphur | 24 | 21.4285 |
| White oxid of zinc | 30 | 26.7857 |
| Vermilion | 10 | 8.9285 |

GRAYISH WHITE

| | Parts | Per Cent |
|---|---|---|
| Caoutchouc | 48 | 28.5714 |
| Sulphur | 24 | 14.2857 |
| White oxid zinc | 96 | 57.1428 |

BLACK

| | | |
|---|---|---|
| Caoutchouc | 48 | 50 |
| Sulphur | 24 | 25 |
| Ivory black or drop black | 24 | 25 |

JET BLACK

| | | |
|---|---|---|
| Caoutchouc | 48 | 40 |
| Sulphur | 24 | 20 |
| Ivory black or drop black | 48 | 40 |

If pure caoutchouc is burned, there should be but about 3 per cent of dark ash remaining. Sulphur and vermilion (mercuric sulphid) leave no ash; hence the percentage of ash from rubber containing these materials should be less than 3 in the ratio of the amount of these materials to the caoutchouc. Some rubbers leave as high as 60 per cent of ash. It would be reasonable to suppose that the strength would be reduced in ratio to the amount of the ash, but this is not true, as the pure gum and sulphur produce the strongest vulcanite. The red and black are nearly the same strength, although the black rubber will leave a much larger ash than the red, because the coloring matter is animal charcoal composed largely of phosphate and carbonate of lime, while the mercuric sulphid would be entirely volatilized. The oxid of zinc and other earthy matter in the pink and white rubbers have a very deleterious effect on the flexibility and tenacity of the vulcanized rubber, so much so, in fact, that these light colored vulcanites are not one-fourth so strong as the brown, red or black.

*Physical Properties of Vulcanite.*—Vulcanite is hard, flexible, and hornlike in texture. George B. Snow gives the specific gravity of a specimen of black vulcanite as 1.1974; and that of the same piece before vulcanizing as 1.1333. The specific gravity varies, as it is much affected by the coloring matter, and is also increased by the temperature and time of vulcanization. "Rubber expands by heat more rapidly than any other solid body. Its rate of expansion at ordinary temperatures, from 70 to 90 F., is over six times that of iron, about five times that

of brass, and nearly four times that of zinc, which is the most susceptible to expansion by heat of any of the metals except mercury. Its rate of expansion is known to increase as the temperature rises, but it has not been definitely determined." In vulcanizing soon after chemical action begins (248 F.), expansion ceases and shrinkage commences, the latter being much affected by the foreign matter present, by a high or low temperature and by a long or short time of vulcanization. Its increased specific gravity is due to this shrinkage.

The usual solvents of caoutchouc have but little action on vulcanite, and no agent which can be tolerated in the mouth has any action on it. It is susceptible of a high polish. It is very opaque, and, therefore, does not imitate well the appearance of the mucous membrane. It is a very poor conductor of heat and electricity, in consequence of which it is not conducive to the health of the tissues upon which it is worn. When improperly vulcanized, it becomes so contaminated with decomposing secretions that it is exceedingly offensive. Great care should be used in vulcanizing rubber that is to be worn in the mouth, and the patient should be thoroughly instructed in cleaning it.

New rubber can be added to old vulcanite by reheating; hence, vulcanite dentures can be easily repaired. It is unnecessary to add a solution of rubber to vulcanite to aid in its repair, as the solvent has no action on the vulcanite, leaving only a thin layer of soft rubber to penetrate the irregular surface of the vulcanite, a result better accomplished by heat and pressure.

These terse statements of the physical properties of vulcanite may profitably be amplified.

Vulcanite is without doubt the most popular denture base material employed by the dental profession. It has many characteristics which render it peculiarly applicable to the requirements at hand, and yet it is far from the ideal material.

Vulcanite answers or falls short of the ideal qualifications for the perfect denture base in the following ways: It is not entirely free from being acted on by the secretions of the mouth, especially in those cases in which the curing process has not been accurately carried out. While it may be said to be practically odorless and tasteless, it remains so only if it is diligently cared for by the patient. It does not readily change its form in the mouth under the stress of mastication; is dense and nonporous when correctly cured, and has an immense amount of expansion and contraction during the curing process. It is a very poor conductor of heat, and because of this fact is very uncomfortable to the patient and may produce a highly inflamed condition in the mouth. It in no way inhibits bacterial growth; on the contrary, it may become the seat of bacterial activity. It conforms accurately to a cast of the mouth, thus giving excellent adaptation. It does not harmonize in color with the tissues of the oral cavity, and is valueless from the standpoint of esthetics. Its surface hardness is sufficient when properly cured and cared for. Its ease of manipulation has done more to popularize vulcanite as a base material than any other one quality. It is the easiest of all base materials to successfully repair; is the lightest of all substances used in the mouth, its specific gravity being from 1.15 to 1.75, while aluminum, the lightest metal suitable for use in the mouth, has a specific gravity of from 2.5 to 2.7, and is inexpensive, both as to cost of

material and labor in construction, this bringing it within the reach of patients unable to afford metal bases.

It has often been said that vulcanite is a porous material. This statement is not true. As early as 1869, investigation had answered this question. The following is a portion of a report submitted by a committee appointed to investigate this subject:

> In repeated examinations made to test this (porosity), by high power of the microscope, nothing resembling pores has ever presented. It has been found impossible to procure a section thin enough to transmit light, although ground to extreme tenuity. Examined as an opaque object, it presents a homogeneous mass, with no appearance of openings for the admissions of fluids; nor have we ever been able to discover moisture in specimens that have been worn. That it is impenetrable to moisture in the ordinary process of wear is apparent in the nonincrease of weight.

Red and pink rubbers are considered by some to be injurious because of their coloring matter, vermilion or mercuric sulphid. This criticism is unjust, because pure mercuric sulphid is insoluble in water, alcohol, alkali and all acids, except nitrohydrochloric acid, which under no conditions should come in contact with red or pink vulcanite. It is evident that the heat of the vulcanizer cannot decompose vermilion because in its manufacture the ingredients are subjected for many hours to a temperature approximately 1,200 F.; and, therefore, it would be unreasonable to expect a temperature of under 400 F. to undo the work of three times as great a heat. It is possible that there may be free mercury in red rubber, but if so, it is because it was placed there by the manufacturer of a poor quality of vermilion. Therefore, the dentist should use only the highest grade rubbers of reliable manufacturers.

### GUTTAPERCHA

Next in our list of plastic base materials is guttapercha, a vegetable substance similar in character to rubber and, in this day and age, so seldom used as a base material that little time will be spent here in the discussion of its qualities.

### CELLULOID

When vulcanite first became popular as a base material, the Goodyear Rubber Company obtained from the United States Government a process patent and proceeded to collect royalties from the dental profession for the vulcanite denture bases which they constructed. This soon led to much litigation in the courts and also a wide search for a suitable base material to take its place. An Englishman named Parks had only recently invented a plastic vegetable compound which he had named parksite or zylonite, which was later to be called celluloid.

In 1860, Dr. McClelland, of Louisville, Ky., made some valuable improvements on this material, rendering it very desirable as a denture base material, and gave it the name of "rose pearl." For a time, this product was very popular, but owing to the settlement of the Goodyear process patent litigation and the development of many objectionable features, it soon fell into disuse, so much so in fact that, for the past thirty-five years, a celluloid denture in many localities has been somewhat of a curiosity.

About 1915, this material again made its appearance. This time, it received its stimulus from a European concern, but its progress was almost totally halted by the World War, which was in progress at that time. Since the settlement of that great conflict, similar materials have reappeared, the most popular one in this

country being sold under the trade name of "hecolite."

Celluloid is made from pyroxylin, or the woody or fibrous parts of plants. This material is treated with nitric and sulphuric acids, after which it is known as nitrocellulose or guncotton, a highly explosive substance.

The proportions of this material with other substances as used for denture base materials is about as follows: guncotton, 100 parts; camphor, 40; white oxid of zinc, 2, and vermilion, 0.06.

Zylonite is made by first dissolving the guncotton in ether or methyl alcohol and then combining it with the other ingredients. Celluloid is made by effecting the union of several ingredients by means of heat and pressure without first dissolving the guncotton.

Pure celluloid, as it is maufactured, is a pale amber, almost as transparent as glass. If one desires to make it white like ivory, oxid of zinc is used. For other colors, various mineral pigments are incorporated in it, or dyes soluble in alcohol, or any of the anilin dyes may be caused to permeate the material and give it the desired color.

The merits of celluloid as a material for a denture base may be summed up as follows: It is hard and elastic, having a hardness ranging from horn to that of ivory, is tough as whalebone, and in elasticity, it greatly exceeds ivory. In the conductivity of thermal change, it is so much like vulcanite that it is difficult to distinguish a difference. Celluloid is easily pressed or molded at a temperature of from 250 to 300 F., and has a specific gravity of about 1.4. It is generally believed to be superior to vulcanite in strength. This characteristic is most variable, depending largely on the pressing and curing process. Perhaps its greatest recommendation lies in its esthetic value. Few, if any, other base materials have the translucence of celluloid base dentures and its resemblance to living tissue.

The principal disadvantages of this material as a denture base may be enumerated as follows: In some cases, there seems to be a gradual solution of the substance by the fluids of the mouth, which results in a gradual thinning of the base and consequent breakage. When it is used for some time, in many instances, a very disagreeable odor develops, so objectionable that the denture cannot be worn with comfort. The base often becomes badly discolored, assuming a dirty brown appearance. The pressure required to press the base often distorts the cast, which results in faulty adaptation. Many of these disadvantages result from employment of a faulty technic during construction, and should not be credited altogether to the material itself.

Generally speaking, the best results are obtained by pressing celluloid in a dry chamber at a high temperature, continuing the process as long as may be consistent with the work in hand. By this method, the volatile constituents are driven off and the material is rendered more dense and compact, while its elasticity is increased and its color improved over the product resulting from the moist process.

Steam, oil or glycerin softens the plaster matrix and flask investment as well, rendering them more susceptible to compressive force and consequent distortion in closing the flask. When dry heat is employed, the flask contents become hardened by the evaporation of moisture before the compression force is applied, and consequently, there is less liability of warpage and distortion than by the moist method.

The chief objection to the dry method is the danger of burning the celluloid

blank during the process of pressing. By the cutting of ample waste gates in the plaster investment surrounding the matrix, so that no surplus material comes in contact with the metal flask, this danger is largely overcome.

An extra large size flask for investment purposes is necessary in order to afford the needed space for deep and wide gates.

The flask should be of the same general form as a vulcanite flask, but larger and heavier throughout. The guide pins should be strong and long enough to hold the two halves of the flask in proper relation to each other when separated by the introduction of the unpressed blank.

The general conclusions regarding celluloid as a base for artificial dentures may be summed up as follows: It is not so durable a material as vulcanite, but it certainly deserves consideration as a serviceable and inexpensive base for artificial dentures because of its close resemblance to the natural gum tissues.

Next in order is the newest addition to the plastic group, namely, the condensites or the phenol resins. As a matter of convenience, let us pass over this group for the time being, returning to them later for consideration.

We will now consider the cast and swaged denture bases, which employ many of the noble metals and their various combinations and alloys. First, let us consider some of the advantages of a metal over a plastic base. Here, it is difficult to name these various characteristics in the order of their importance, but the one usually receiving first consideration is the element of strength. Metal bases are much less likely to fracture than plastic bases, and, in each case, except the lower cheoplastic, this additional strength is gained with a reduction of bulk. The general health of the mucosa underlying the metal base is usually much better than that found under the plastic base. Most metal bases resist action by the fluids of the mouth as well as do those of the plastic type. Metal bases do not readily change form under stress. The elements of expansion and contraction are well cared for in the modern technics of construction. All metal bases transmit heat or cold much more readily than do plastic bases. Bacterial deposits will grow on metal bases, but to a much less degree than on the plastic type. Adaptation equal to that of any other kind of base may be secured with metals. Metal bases are much easier to keep clean and in a hygienic condition than are other kinds.

The chief disadvantages of the metal base are the difficulty of construction and the added expense to the patient.

### METAL BASES

We now find our metal bases divided into two classifications: (1) the cast metal bases and (2) the swaged metal bases.

*Cast Metal Bases.*—This is neither the proper time nor the place to enter into a discussion of the various casting technics or the various kinds of metals and alloys employed. We will consider only briefly some of the advantages and disadvantages of this type of a denture base.

The technic of construction is somewhat simpler than that of the swaged base. A closer adaptation throughout the base area may be obtained. Cast bases are more bulky than those of the swaged type. They are also more subject to breakage and a large percentage of them are porous. The best technics require swaging of the base after casting.

The cast metal base has added much to the field of full denture construction, and some prosthetists choose to use it

almost exclusively in their highly successful practices.

*Swaged Metal Bases.*—Here, we find a base that seems very nearly to meet all requirements. While it is true that the technic involved in its construction is somewhat more complicated, the results seem to justify the effort.

There are many advantages to the swaged metal base. Sufficient adaptation is not difficult to obtain. It may be the most thinly constructed of all types of bases. It is the densest and strongest base known. Its smooth polished surfaces offer the least lodgment for food deposits and bacterial growth, and are the easiest to keep clean. The highest degree of tissue tolerance is obtained. This base may be easily reswaged in accordance with tissue change; and there is a choice of a larger field of metals which may be used.

Generally speaking, the swaged metal base seems to have the greatest number of advantages and the fewest disadvantages of all denture bases.

*Metals Used in Swaged and Cast Bases.*—Generally speaking, there is but one metal that is used in its pure form in metal base construction, and that is platinum. Here, the fusing point and the coefficient of expansion are seldom altered by alloying, especially when it is to be used as a base for fused porcelain.

Stainless steel has recently been used in a small way as a swaged base material, but its use has been so limited and the results have been so questionable that its consideration here is scarcely warranted. This product, given to the profession in 1919 by a German steel concern, was for a time recommended and largely used throughout Europe. Recent experience has largely restricted its use to the field of partial dentures.

Gold forms the basis for by far the greatest number of base metals, but it is never used alone because of its soft, pliable nature.

The number of gold alloys recommended for cast and swaged bases is so great that it is impossible to discuss them separately. It is sufficient to say that each has its advantages and disadvantages, its indications and contraindications, and its use remains a matter of personal choice, depending on the likes and dislikes of the operator.

Only a few years ago, an alloy consisting of tin, 16 ounces, and bismuth, 1 ounce, was used quite extensively in casting lower denture bases, but modern technics of impression taking and denture finishing have largely displaced this material.

In the last few years, an alloy has been placed on the market consisting of palladium, 1 part, and silver, 2 parts. The result is a metal having characteristics which fit it peculiarly for swaged bases. It is the strongest of all base metals known except stainless steel. This unusual strength makes it possible to construct a base of exceptional thinness. Its specific gravity is only a little more than one-half that of gold, which makes it a denture base of unusual lightness. Laboratory tests have shown this metal to possess a marked inhibitory action toward bacterial growth. It takes a beautiful high polish and retains it in the mouth longer than any other base material.

The only disadvantage that can be ascribed to this material is the difficulty of manipulation, but a technic has been developed by W. J. Pryor of Cleveland, Ohio, which largely overcomes this.

There are many other different alloys and technics for denture bases that cannot be given time and consideration here, but it is believed that they will all come under some one of the general classifica-

tions that have been described in this paper.

PHENOL-RESIN PRODUCTS

To return to the plastic bases: This material, namely, the phenol-resin products, has obtained almost unbelievable popularity in the denture field in the past few months.

There has been much conflict and confusion caused by the wide variety of trade names which have been applied to this new material: condensite, bakelite and redmonol are just a few examples. The correct chemical name for this product is polymerized oxybenzol methylene glycol anhydrid, but, as a matter of convenience, we shall speak of it as either phenol-resin or bakelite, as it is more generally known by these terms.

In 1872, Prof. Adolph von Bayer, a German, made the important discovery that when phenol and formalin (solution of formaldehyd) were united and kept in an elevated temperature, a soft sticky mass unlike either of the original materials was the result. Many men worked with this product, but accomplished nothing until 1909, when L. H. Bakeland, a Belgian chemist working in America, discovered that by a continued application of heat plus pressure, the sticky honeylike mass of von Bayer's product became a hard resin. He also discovered that the reaction between phenol and formalin was much improved by the addition of an alkaline as a catalytic agent.

Dr. Bakeland's new material received the name "bakelite" and almost immediately found its place in the commercial world. Bakelite can be produced in many different ways; for example, the use of formin, or hexamethylene tetramin in place of formalin will produce similar results, as will the use of naphthalene (moth balls).

Of the principal ingredients of bakelite, phenol is a crystalline substance having a low melting point and formalin is a 40 per cent solution of formaldehyd gas in water. When formalin is evaporated, it leaves a white powder mass, paraformaldehyd, the result of the combination of the formaldehyd molecules. When paraformaldehyd is heated to the proper temperature, it again becomes formaldehyd gas.

In constructing the bakelite which is to be used as a denture base material, every manufacturer has his own individual method, but a very successful material can be made by the following technic and formula. Incidentally, it is reasonable to believe that all technics are much alike.

Just as an example, to equal parts of formalin and melted phenol, sufficient to make in all 5 quarts, 30 c.c. of aqua ammonia is added as a catalyzer. The mixture is then placed in a constant temperature oven, and the action begins at once. The time and the temperature applied at this stage are very important. The higher the temperature, the less the time required; the lower the temperature, the longer the time.

This mixture soon becomes an amber or straw colored mass about the consistency of strained honey.

Paraformaldehyd is now added to the point of saturation, and the process is continued under elevated temperature until a very thick, viscous, sticky mass is obtained, which we will call bakelite A. The entire mass is now divided into smaller batches of approximately 1 quart each in volume, and placed in a water bath of about 212 F., where it soon becomes quite fluid. It is at this point that the various ingredients are added which make the dental product different from the commercial bakelite.

The next step is the introduction of the coloring material. Bakelite is extremely sensitive to color and this step requires the utmost accuracy and skill. The coloring material usually used is carmin, and this is mixed with a small portion of glacial acetic acid and clear mineral oil. To this colored mass is now added a plasticizer or substance to reduce the brittleness, and for this purpose we will use "lindol" or tricresol phosphate. There are several other materials which may be used for this purpose also. In order to increase the tensile strength, a binder of wood pulp is next added. Possibly, the greatest recommendation for this material is the translucent lifelike appearance which it possesses, and this is produced by the addition of titanium oxid or barium sulphate. The mixture is now completed, and it is maintained at the desired temperature until the proper consistency is reached, which is dependent on the judgment of the observer. The human element here plays an important part and no doubt accounts for many of the failures experienced in the past.

The bakelite molecule is extremely complex and is highly susceptible to the slightest change, which indicates the great difficulty of constancy in manufacture.

After cooking is complete, it is chilled in a refrigerator to approximately 40 F., and can be kept in this manner for several weeks without noticeable change. When taken from the refrigerator, the material is placed upon a cloth tray and subjected to a slight raise in temperature, when it becomes a flat sheet, and this flat slab or sheet of material is cut up into marketable form. Here, again, constant watching and testing are necessary in order that the cure may not be advanced too far. Again, the human factor plays a very important part, and the slightest error may completely change the finished product.

The whole process involves a constant elevation of temperature. The manufacturer carries the cure to a certain point; the dentist merely finishes the process. If the manufacturer's time varies in the least, in that proportion must the curing time of the dentist vary.

This material has been used rather extensively during the past two years, with a wide variation of results. One of the complaints often heard is that the finished dentures have a tendency to check or crack. There may be many causes for this condition, but certainly one of them is the kind of formalin used. When the formalin comes from the chemical manufacturer, it contains alcohol to prevent the formation of paraformaldehyd. If the ratio of alcohol to the formalin solution is not correct, checking of the surface of the finished denture will result.

*Air Bubbles.*—May I repeat that the application of heat in the curing process is merely a continuation of the heating process of manufacture. During this final curing process, the material congeals rather suddenly, and should the temperature be too high in the initial stage, it will cause the entrapping of bubbles much the same as porous vulcanite is formed.

*Undercuring and Overcuring.*—Undercuring leaves the denture in an unfinished condition and results in its continued changing in the mouth. The most noticeable effect is a kind of surface blistering. Overcuring is indicated by the fact that the denture is extremely brittle and takes on a chalklike appearance. Discoloration may be partially caused by excessive alkalinity, which causes the denture to turn brownish, and if the alkaline solution is sufficiently strong, it will disintegrate the material.

The solvents for bakelite are alcohol and acetone. These are not effective unless applied under pressure and elevated temperature.

*Dimensional Change or Warpage.*—Dimensional change depends to a great degree on the accuracy and perfection of the curing process. All bakelite bases will change more or less, in time. This change will take place much more rapidly in air than in water. Therefore, patients wearing such dentures should always be instructed to keep them moist.

Expansion and contraction are practically nonexistent as far as they are likely to affect the resultant efficiency of the denture. Three dimensional changes are also relatively small when compared to those associated with vulcanite or other plastic base materials.

If a bakelite denture is heated in hot water and the heels are pressed together and chilled, the case will remain in that position indefinitely. If the case is boiled again, it will resume virtually its original shape on the cast. This shows that any changes taking place in the material are not temperature changes but are probably due to the relation of the water to the bakelite molecule.

*Bakelite Used on a Metal Base.*—The difference in the coefficient of expansion between a metal base and bakelite causes the latter to check, because the metal will not give or break to compensate for the difference. This condition does not always exist sufficiently to cause any great trouble, because it is here that we see the most beautiful as well as the most practical results. It is advisable in such cases never to bring the metal base over the ridge farther than is necessary.

*Final Curing.*—In the production of commercial bakelite objects, steel dies and hydraulic pressure, combined with elevated temperature, are used to eliminate air bubbles. In the dental field, high pressure and steel dies are impossible. At the present time, we must, therefore, resort to delicate temperature control and ventilation, the latter being secured by puncturing the tinfoil lining the matrix with a small needle.

The function of the medium in the vulcanizer pot is to transmit this temperature and pressure to the case. Curing can be accomplished in a warm-air oven at low temperature and over a long period of time, but the product is more likely to show bubbles because of the absence of pressure. Alcohol in one of its forms is almost universally used as this medium.

It may seem strange to use alcohol as the curing medium when it also is a solvent of the bakelite. It does not come in contact with the denture, as the flask joints are sealed by the early curing of the thin edges at the joints, and the water in the plaster matrix acts as a water jacket, insulating the denture against the alcohol.

If the alcohol comes in direct contact with the base, it will come from the flask as an almost transparent material. This is sometimes shown in a cracked plaster matrix or in a flasked case which has been thoroughly dehydrated before curing.

In buying bakelite base materials from the dental supply house, it is important that fresh stock be obtained because of the fact that this material will continue its cure on the shelf of the supply depot and may come to the operator advanced to such a stage that it is worthless.

A word of warning is here issued to those contemplating the use of any one of the many different products of bakelite now on the market. Do not be misled by the many extravagant claims of the manufacturer for his material, but accept and use it as a valuable contribution to den-

tistry that is still most certainly in the experimental stage of development.

About two months ago, I prepared and mailed to 100 carefully selected dentists a questionnaire dealing with this new material. Eighty-two replies were received, and the information given was in every case interesting and in some cases almost startling. By far the great majority of these replies indicated that the dentist had used much of this material, but owing to repeated failure and disappointment, its use had been abandoned or reduced to only those cases suitable for experimental purposes. In fairness to this material, let it be said that the men to whom these questionnaires were sent were chosen because they were believed to be the best and most modern operators in the prosthetic field, and it is only natural that they should be the first to embrace and use a new material of this character, and it is not only possible but also highly probable that much of this disappointment and failure occurred when the material was first placed on the market and was in a cruder state than it is even today.

The following is a list of the questions contained in this questionnaire:

1. In approximately what percentage of your denture work have you used condensite or resin base materials?
2. Approximately what percentage could you speak of as being a complete success from the standpoint of the base material?
3. Have you experienced trouble with warping, checking, continued curing, breaking or fading?
4. Please state your first, second and third choice of these materials, based upon your successes.
5. What temperature formula do you follow for the curing process?
6. What alcohol formula do you find works best?
7. Have your patients ever experienced irritation or soreness under these bases apparently caused by the base material?

As the answers received to these various questions were in many instances so indefinite that little information could be gained from them, the figures here quoted may not be absolutely accurate. They will serve to give some idea as to the sentiment of a large group of representative dentists scattered throughout America regarding these products.

The answers to question 1 indicate that about 4 per cent of all dentures constructed have been on a bakelite base.

The answer to question 2 indicates that about 25 per cent of these dentures, or one in every four, have been successful.

In question 3, each dentist sending in a reply had experienced three or more of the difficulties enumerated.

Question 4 was avoided to such an extent that no answer of value can be given.

In answering question 5, only one man gave a comprehensive temperature formula. This might indicate that the material is not receiving a fair chance or that the commercial laboratories are doing a major portion of our investigation and research for us.

Answers to question 6 tell us that the alcohol formula recommended by the manufacturer is used almost unanimously.

Answers to question 7 indicate that tissues underlying a bakelite base remain in a healthy condition and seldom cause trouble.

Many of the men answering this questionnaire were kind enough to supplement it with a letter giving their views more in detail. These letters were very interesting.

The following letters come from professors of prosthetics in three of our greatest university dental schools, and should carry considerable weight with every one interested in this subject. I

quote from these three letters as representative of the entire group.

Prof. A. says, in part: "It is our opinion that the material is not sufficiently standardized nor the curing process sufficiently definite for general use. It may be that experts in handling the curing of condensite can secure definite results in the majority of cases, but it has been impossible for us."

Prof. B.: "My experience with condensite and resin materials has been a disastrous one. From an esthetic standpoint they are beautiful, but from a serviceable one, I am afraid they are worthless. The large laboratories of this city are likewise of this opinion. They report that it means almost a continual repair and replacement. In a few cases the base plates have broken like so much glass."

Prof. C.: "We have not employed any of these in our clinic for the reason that in the present stage of their development so many uncertainties seem to be attendant upon their use. The reports of men with whom I am in contact and my own attitude all tend in the same direction—to use them only at the patient's request, or with a full explanation of their drawbacks and the understanding that the patient is willing to take a chance for the paramount advantage they offer, namely, naturalness of appearance."

In fairness to another material which we are not at this time considering, I am prompted to state that the majority of the men answering the questionnaire volunteered the information that they were obtaining results with hecolite which were by far superior to those obtained with the bakelite products.

In presenting this paper, I have made an honest effort to present a fair and impartial review of all the denture base materials, and realizing the interest manifested at this time in the bakelite products, I have made a special and sincere effort to obtain the best information possible regarding them. The data regarding this material have perhaps been disappointing to many. They most certainly have been to me, believing as I do that the introduction of the phenol-resin base materials into the field of denture prosthesis is one of the greatest steps forward since the advent of the gold inlay. Just as the horseless carriage became the automobile, and the flying machine became the airplane, so will phenol-resin, or a similar material, become the artificial denture base of the future.

# IMPORTANCE OF NORMAL AND ABNORMAL TOOTH STRUCTURES IN THE PROGRESS OF DENTAL CARIES*

By F. J. BARKER, D.D.S., Chicago, Ill.

AT the present time, the greater part of the research work being done on dental caries appears to be in the field of dietetics, with special reference to the influence of the vitamins. In order to understand the constitutional reactions and the changes produced in the teeth by diet, we must first know the structure of the tissues in which these changes take place. We shall therefore discuss the ways in which caries penetrates the enamel and the dentin, with special reference to the areas of low resistance to decay.

It is generally accepted that the amount of calcification of the hard substances determines the progress of dental caries. We know from clinical experience that the soft chalky teeth of poorly nourished children frequently decay with such rapidity that it is almost impossible for the dental work to keep pace with the progressive destruction. One of the main causes of poor calcification of teeth is rickets. In rickets, the formation of the matrix of the hard substance is changed relatively little, but there is a severe disturbance and delay in the following deposition of calcium salts. In severe cases, the histologic evidence of rickets in the enamel is enamel hypoplasia, while, in milder cases, the stripes of Retzius are clearly evident. A brief description of the origin of these changes will make this clearer. Gottlieb[1] explains enamel hypoplasia as follows: The enamel contains very little organic matrix, and therefore, in cases of rickets, when the deposition of calcium salts is delayed, the poorly calcified enamel is likely to collapse and cause an irregularity of the surface known as enamel hypoplasia. The stripes of Retzius are also evidence of a disturbance in the calcification, but less severe than in the cases of hypoplasia. The enamel did not collapse, but during its deposition in the tooth formation, alternating layers of well and poorly calcified substance were laid down. Thus, the enamel shows a structure similar to that of a tree trunk, with its concentric rings.[2]

Since the dentin consists of more organic matrix than does the enamel, its outer shape is less changed by the delayed calcification. Histologically, we see an unusual amount of uncalcified matrix around the pulp as an enlarged layer of dentinoid, and, between the globuli of

From the Research Department (Director, Rudolf Kronfeld) of the Chicago College of Dental Surgery, Dental Department of Loyola University.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Second Annual Session of the American Dental Association, Denver, Colo., July 25, 1930.

1. Gottlieb, Bernhard: Rachitis and Enamel Hypoplasia, Dent. Cosmos, 62:1209-1221 (Oct.), 1316-1326 (Nov.) 1920.

2. Orban, Balint: Dental Histology and Embryology, Ed. 2, Philadelphia: P. Blakiston's Son and Co., p. 35.

calcification, as the so-called interglobular spaces.

When caries attacks the enamel surface, it encounters a hard calcified substance that contains bands of uncalcified organic material beginning on the outer surface of the tooth and running into the enamel. These formations are the enamel lamellae. As it is evident that an organic band can easily be an area of weak resistance to decay, it is necessary to know about the lamellae and their importance as related to dental caries.

Ebner[4] was of the opinion that they consisted of uncalcified interprismatic substance, and Walkhoff[5] considered them to be uncalcified prisms. Later, Gottlieb[6] studied the problem and found that, after decalcification of the enamel, the lamellae remained, thereby proving that they were organic substances and not artificial cracks. He also found that the lamellae do not necessarily end at the dentino-enamel junction but may penetrate into the dentin. Gottlieb was the first

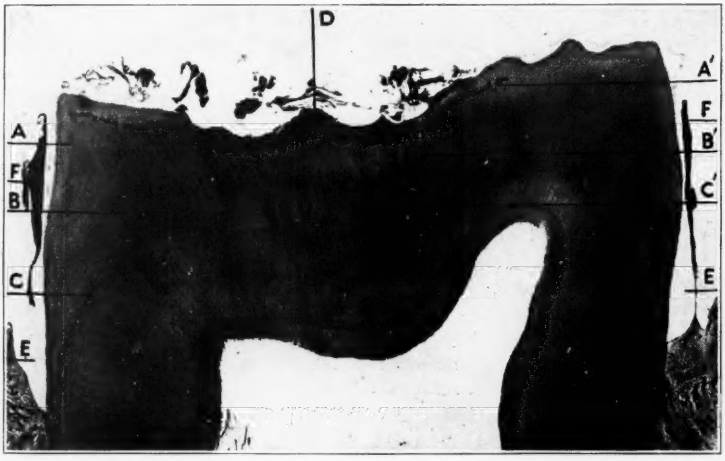


Fig. 1.—Lower first permanent molar, decalcified section. *A, B, C,* three rows of normal interglobular spaces. *A', B', C',* the same three rows of interglobular spaces partially infected by the progressive caries of the dentin. *D,* caries on the surface of the dentin. *E,* space between the epithelial attachment and dentin formerly occupied by enamel. *F,* deposits of calculus on the tooth surface. The pulp in this picture has been partially lost in sectioning. (×16.)

Boedecker[3] was the first to describe enamel lamellae. He stated that they were bunches of organic substance extending from the surface of the enamel to the dentino-enamel junction. Von

3. Bödecker, C. F. W.: Anatomie und Pathologie der Zähne, 1896; Necrosis, Dent. Cosmos, 20:241 (May) 1878.

4. Von Ebner, V.: Histologie der Zähne, Scheff's Handbuch der Zahnheilkunde, Ed. 3, 1909.

5. Walkhoff, O.: Erdsalzarmut und Entartung, 1913.

6. Gottlieb, Bernhard: Untersuchungen uber die organische Substanz im Schmelz menschlicher Zähne, 1915.

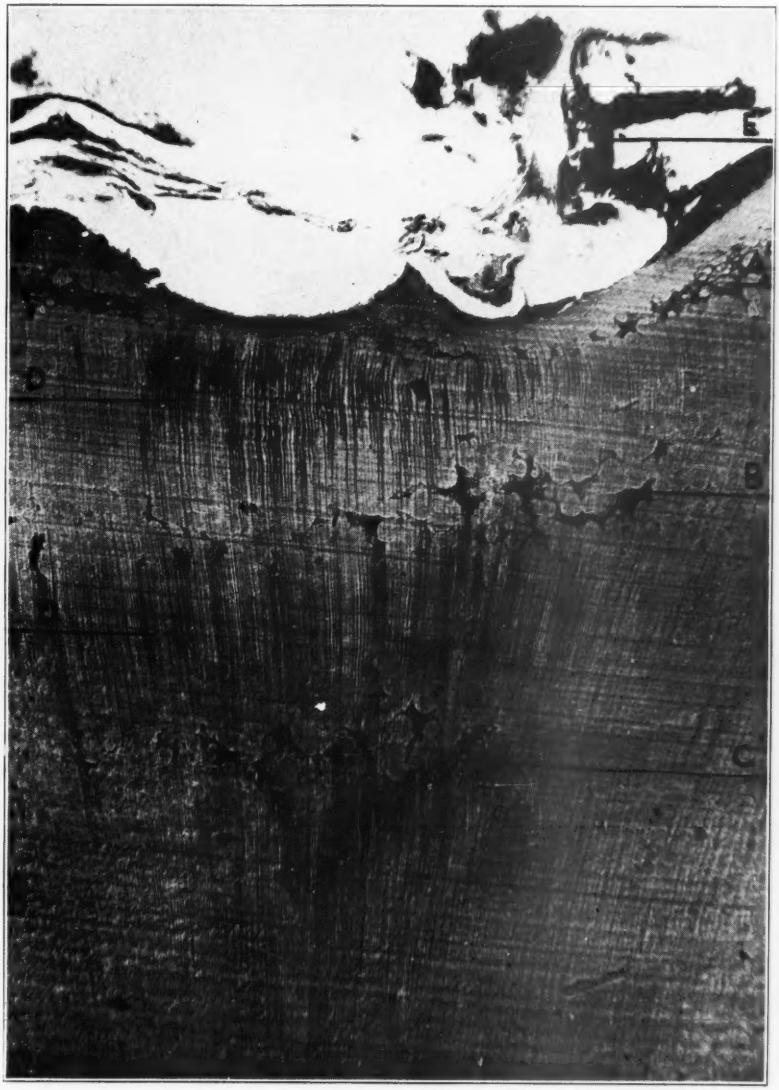


**Fig. 2.—Higher magnification of Figure 1. *A'*, *B'*, *C'*, three rows of infected interglobular spaces. *D*, infected dentinal tubuli. *E*, caries on the surface of the dentin. (×60.)**

to call attention to the enamel lamellae as natural avenues for decay.[7]

There are two types of enamel lamellae.[8] The first consists of poorly calcified enamel substance and may extend from the surface of the tooth into the enamel or to the dentino-enamel junction, but never into the dentin. The second type consists of the remains of the surrounding tissue which grow into crevices of the enamel during tooth formation. The tissues covering the crown at the time these crevices are formed are the inner and outer enamel epithelium. When these tissues grow into a crevice, they form a lamella, the inner part of which is usually derived from the inner enamel epithelium, while the outer part originates from the outer enamel epithelium

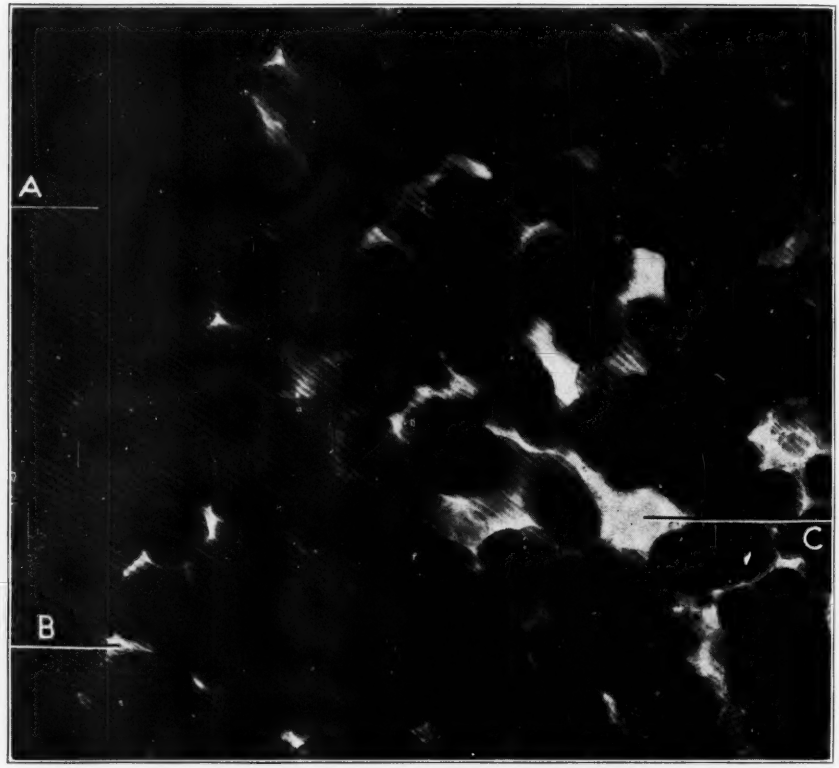


Fig. 3.—Poorly calcified dentin in a human deciduous molar, decalcified section. *A*, well-calcified dentin. *B*, interglobular spaces. *C*, dentinal matrix. The dentinal tubuli are seen running across the picture throughout the dentin. (×250.)

7. Gottlieb, Bernhard: Atiologie und prophylaxe der Zahnkaries, Ztschr. f. Stomatol., No. 3, 1921, Fig. 19.

8. Footnote 2, p. 30-42; Histology of the Enamel Lamellae and Tufts, J. A. D. A., 15: 305 (Feb.) 1928.

Fig. 4.—High magnification of the dentin, showing the progress of caries in the dentinal tubuli; decalcified section. *A, A'*, infected dentinal tubuli. *B*, area of infection ending in an interglobular space. *C*, normal dentin. The arrow indicates the direction in which the caries progresses. (×540.)

and can be hornified the same as the secondary cuticle.

As long as this hornified layer remains intact over the entrance of the lamellae, no dental caries can occur. If this cuticle is missing or destroyed in some way, the organic content of the crevice is exposed and forms an area susceptible to dental caries. It is not probable that the lamellae have any connection with rickets or disturbed calcification. A disturbance during the time of the enamel formation must show in the enamel in a plane parallel to the tooth surface, that is, parallel to the stripes of Retzius. As the lamellae run crossways to the direction of the deposition of the enamel layers throughout the entire thickness of the enamel, they cannot be due to a deficiency of calcification.

We shall now describe a case of beginning caries in a lower first permanent molar of a child, aged 8 years. As the tissues were decalcified and imbedded in celloidin, only the organic parts of the enamel are left. This enables us to trace the course of caries through the organic structures of the enamel toward the dentino-enamel junction as well as its progress through the dentinal tubuli and interglobular spaces.

In Figure 1, the crown of the lower first permanent molar is shown. The tooth had beginning caries on the occlusal surface which had merely reached the superficial part of the dentin under the central fissure. The dark masses, *D*, found in this area are disintegrated and decalcified parts of enamel lying freely above the dentin surface. The dentin of this tooth on both sides shows fairly good calcification and therefore no excess of interglobular spaces. The interglobular spaces, *A*, *B*, *C*, are merely indistinct lines running about parallel to the tooth surface. They correspond to the periods of poorer calcification in the formation of the dentin. Toward the region of the occlusal fissure, the interglobular spaces change and become dark lines, *A'*, *B'*, *C'*, forming a direct continuation with the formerly described spaces, *A*, *B*, *C*.

Figure 2 shows a higher magnification of the central part of the crown described in Figure 1. The remains of enamel and masses of caries can be seen at *E*. The three lines of interglobular spaces, *A'*, *B'*, *C'*, show distinctly as dark irregular areas in the dentin. Between these lines, the dentinal tubuli, *D*, of unusually dark appearance, are found. Their dark color is caused by infection and the presence of masses of bacteria in their lumen. In normal dentin, Tomes' fibers take a light stain; whereas, in the cases of infected dentinal tubuli, the masses of bacteria stain dark blue, thus appearing as dark lines in the photomicrograph. A similar condition is found in the interglobular spaces. In normal dentin, the spaces show a shade typical of uncalcified dentinal matrix, that is, lighter than the surrounding calcified dentin. In cases of caries and infection of the dentin, the bacteria are more likely to spread in the uncalcified tissue of the interglobular space than in the well-calcified surrounding dentin. In Figure 2, the route taken by the infection is shown by the dark appearance of the decayed dentin. The infection follows the dentinal tubuli from the surface toward the center of the dentin, then spreads in the first row of interglobular spaces, *A*, from which it follows the next part of the dentinal tubuli to the following row of interglobular spaces, *B*; and so on throughout the dentin.

The following pictures show higher magnifications of the relation of the progressive infection to the dentinal tubuli and the interglobular spaces. Before these pictures are described, the origin

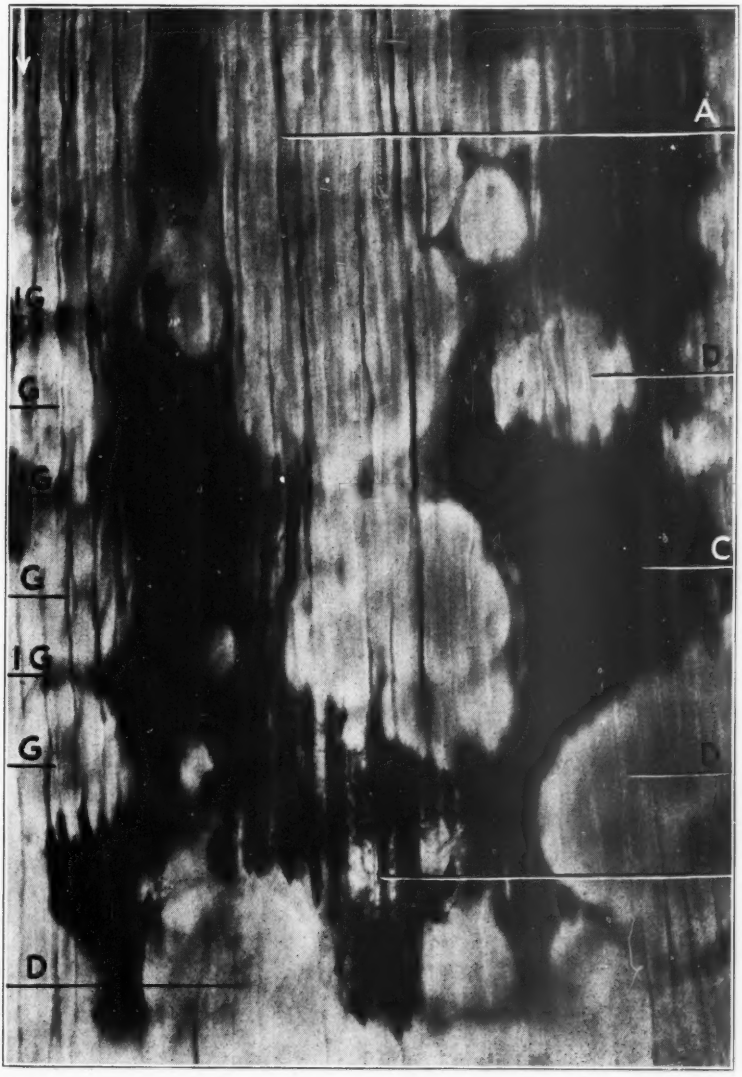


Fig. 5.—Caries of the dentin and its relation to the interglobular spaces. *A*, infected dentinal tubuli. *B*, area of infection spreading from the dentinal tubuli in an interglobular space. *C*, disintegrated dentinal tubuli in an interglobular space. *D*, globuli of well-calcified dentin. *G*, infected dentinal tubuli running through globuli of calcification. *IG*, infected dentinal tubuli running through interglobular spaces. The arrow indicates the direction in which the caries progresses. (×540.)

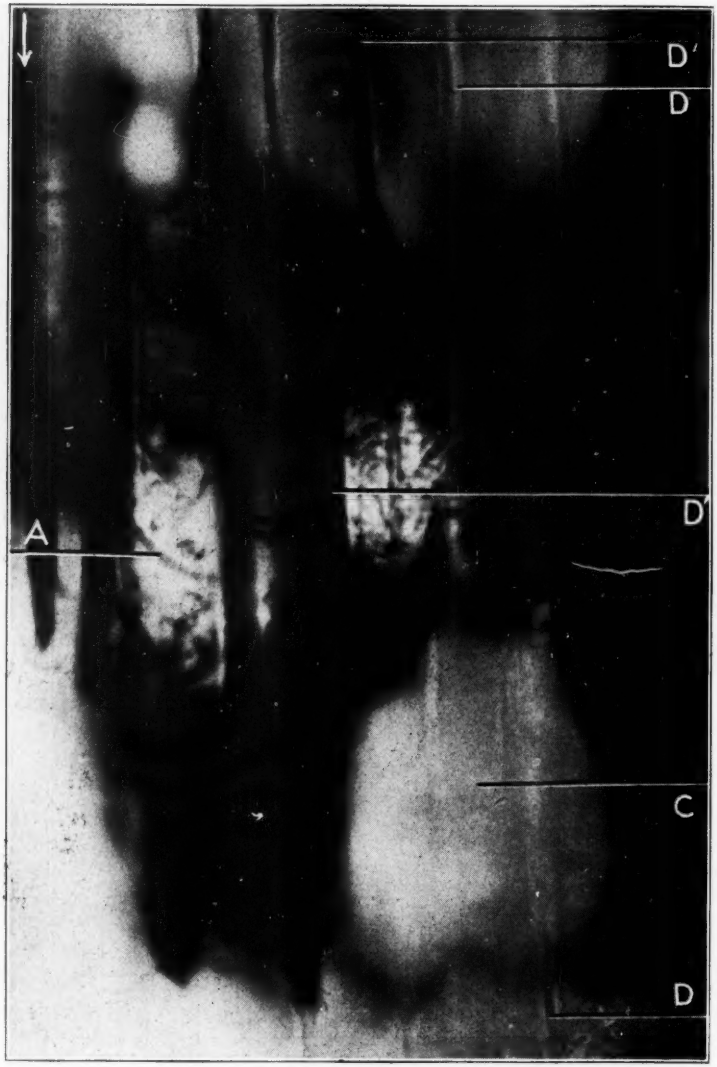


Fig. 6.—Higher magnification of area *B*, Figure 5. *D*, normal dentinal tubuli. *D'*, infected dentinal tubuli. *A*, anastomosing branches of the dentinal tubuli. *C*, globule of calcification. The arrow indicates the direction in which the caries progresses. (×1,600.)

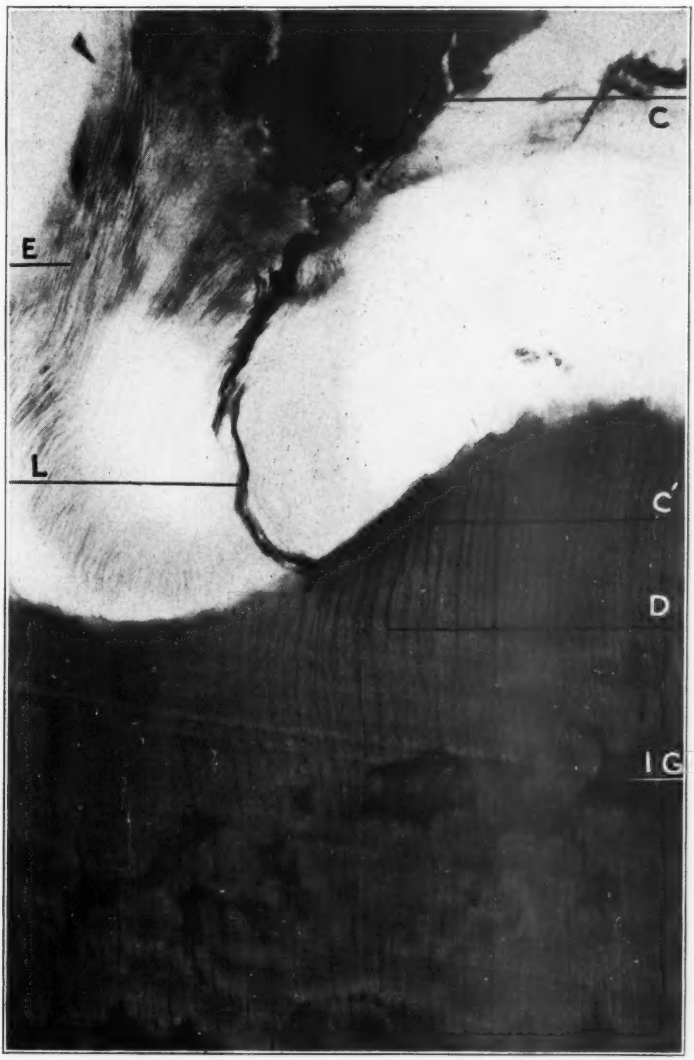


Fig. 7.—Lower first permanent molar, decalcified section. *C*, caries on the occlusal surface. *E*, remains of enamel. *L*, enamel lamella. *C'*, caries spreading horizontally along the dentino-enamel junction. *D*, infected dentinal tubuli. *IG*, infected interglobular spaces. (×250.)

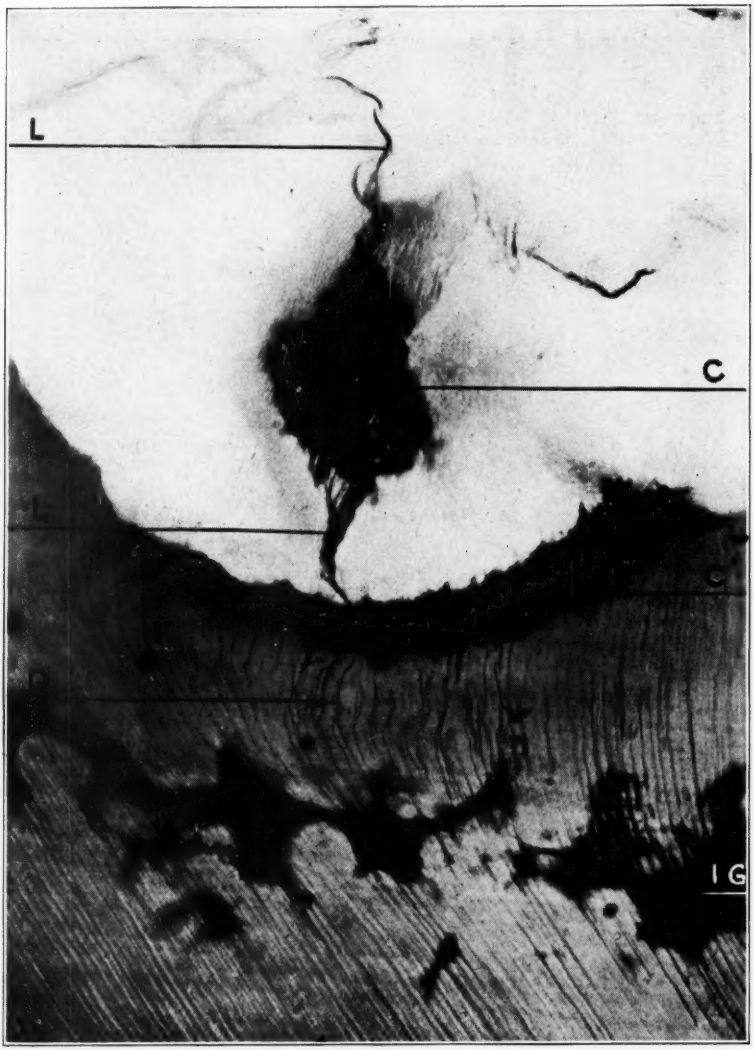


Fig. 8.—Another area of the tooth shown in Figure 7. *L*, enamel lamella. *C*, caries of the enamel. *C'*, caries spreading horizontally along the dentino-enamel junction. *D*, infected dentinal tubuli showing terminal ramifications. *IG*, infected interglobular spaces. (×250.)

and appearance of the interglobular spaces will be shown. Figure 3 is taken from a poorly calcified human deciduous tooth. On the right side of the dentin

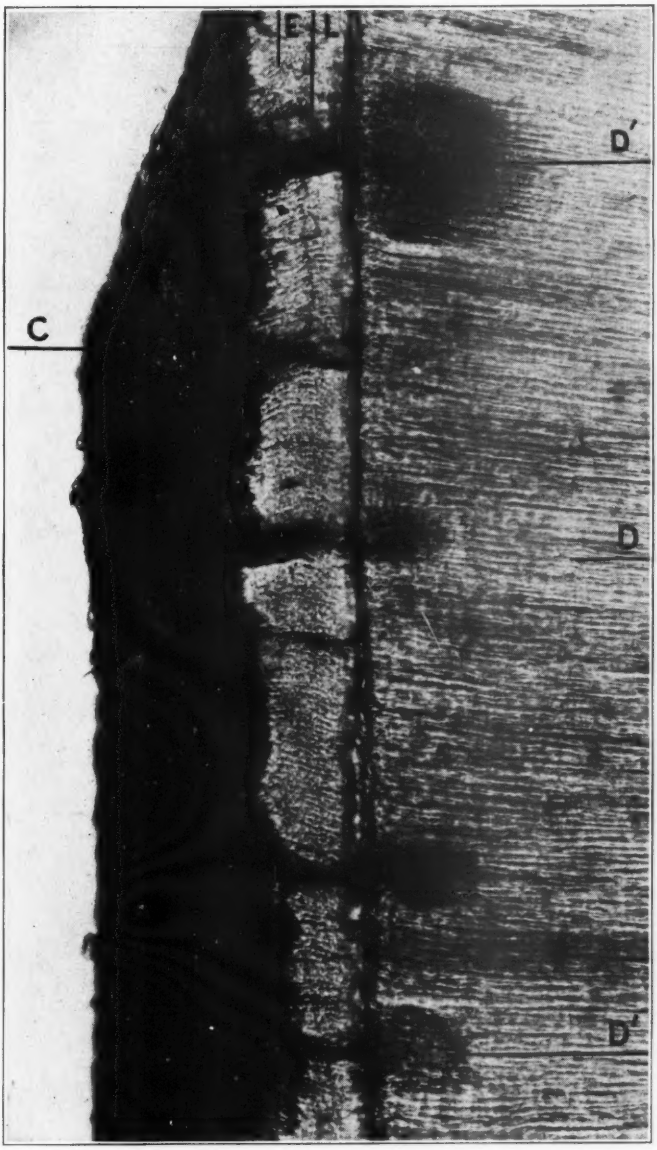


Fig. 9.—Horizontal ground section through a human bicuspid, unstained. *E*, normal enamel. *L*, enamel lamellae. *C*, caries of the outer part of the enamel. *D*, normal dentin. *D′*, caries spreading into the dentin corresponding to the base of the lamellae. (×200.)

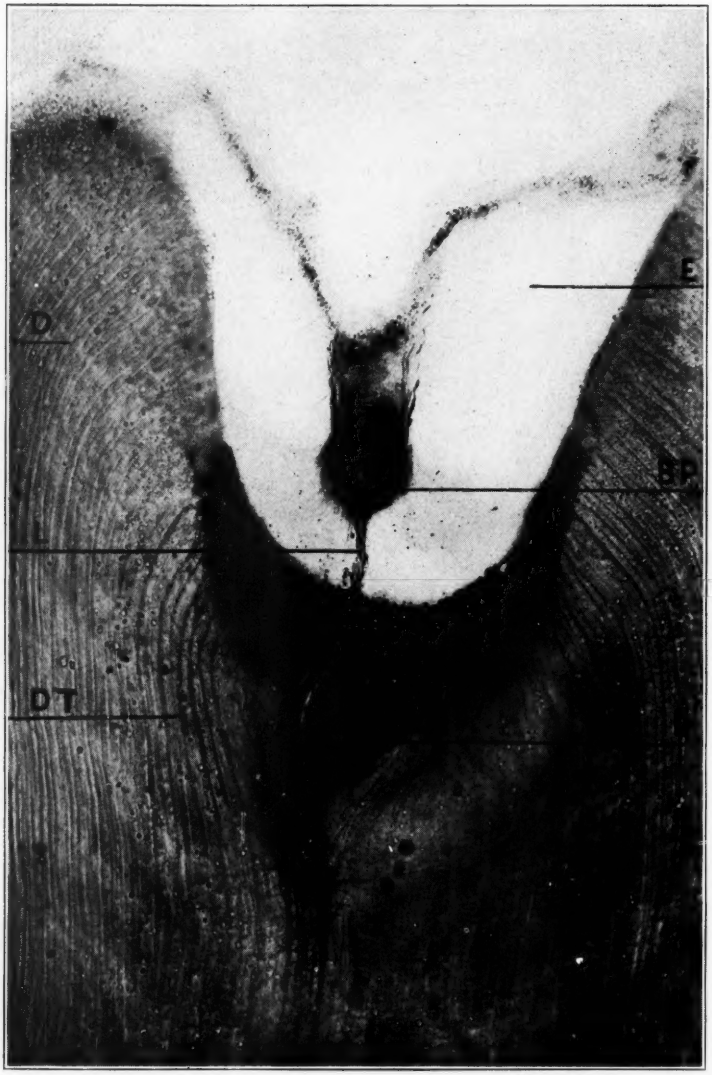


Fig. 10.—Caries in an occlusal fissure of a molar of a white rat; decalcified section. *D*, dentin. *E*, space formerly occupied by enamel. *BP*, bottom of the occlusal pit (pit filled with débris). *L*, enamel lamella. *D'*, caries of the dentin. *DT*, infected dentinal tubuli.

are the light areas of the dentinal matrix, *C*. As the calcification continues, small dark globuli of calcium salts appear. These globuli grow by the gradual deposition of inorganic substance, and finally come in contact, leaving small areas of uncalcified matrix between them (Fig. 3, *B*). These areas sometimes disappear entirely after further calcification, and thus normal, completely calcified dentin results, as illustrated on the left side of Fig. 3 at *A*. It is important to know that the dentinal tubuli run continuously and uniformly through all the dentin, whether calcified or not.

As caries reaches the dentino-enamel junction, the bacteria follow the course of the dentinal tubuli. As long as the tubuli are surrounded by well-calcified dentin, the infection, at the beginning at least, will be restricted to their organic content. If the decay during its progress along Tomes' fibers reaches an interglobular space, it can easily spread to the side walls, since the uncalcified matrix offers much less resistance than the well-calcified dentin. On the other hand, there seem to be areas of good calcification, probably corresponding to the areas of transparency in the dentin, for, at certain places, the progress of the caries is completely interrupted. Figure 4 shows a condition like this. In the picture, the arrow indicates the direction in which the caries is traveling. At *A*, the infected dentinal tubuli are in more or less continuous lines; at *A'*, they appear in two groups; while at *C*, the dentin appears normal. Between *B* and *C*, the progress of decay stops with marked abruptness. The outline between the infected dentin *B* and noninfected dentin *C* makes it probable that, at this point, the caries reached the surface of a formerly well-calcified globule.

The relation of caries to the calcification of the dentin is more distinct in Figure 5, which was taken from a decayed area containing large interglobular spaces. The infected dentinal tubuli running through the dentin appear as thin black lines, *A*. As they enter the interglobular spaces at *B*, they enlarge and finally disintegrate, for example, at *C*. Such interglobular spaces appear under the microscope to be dark blue homogeneous masses, evidently consisting of disintegrated dentin and bacteria. Since the progress of infection frequently stops at the lower border of these spaces, the globuli of good calcification, *D*, are the light areas with no evidence of caries. On the left side of the picture, slightly infected tubuli can be seen running alternately through calcified globuli, *G*, and small areas of interglobular spaces, *IG*. As the tubuli pass through these spaces, they show remarkable swelling and thickening, but, in the globuli, they again assume a normal size.

In summarizing the findings in Figure 5, the conclusions concerning the progress of caries in the dentin are as follows: Infection and decay follow Tomes' fibers, and therefore run parallel to the dentinal tubuli. The resistance offered by the walls of the dentinal tubuli determines, to a great extent, the amount and rate of the progress of the caries. The decay, at least in its early stages, is restricted to the content of the tubuli as long as they run through areas of good calcification. If they pass an interglobular space, the bacteria can more easily attack the walls. Such a condition can be seen at *G*, and *IG*, Figure 5, and even better in Figure 6, which is a higher magnification of area *B*, Figure 5. The upper part of Figure 6 shows five distinct dentinal tubuli. The three on the left, *D'*, are filled with a structureless blue sub-

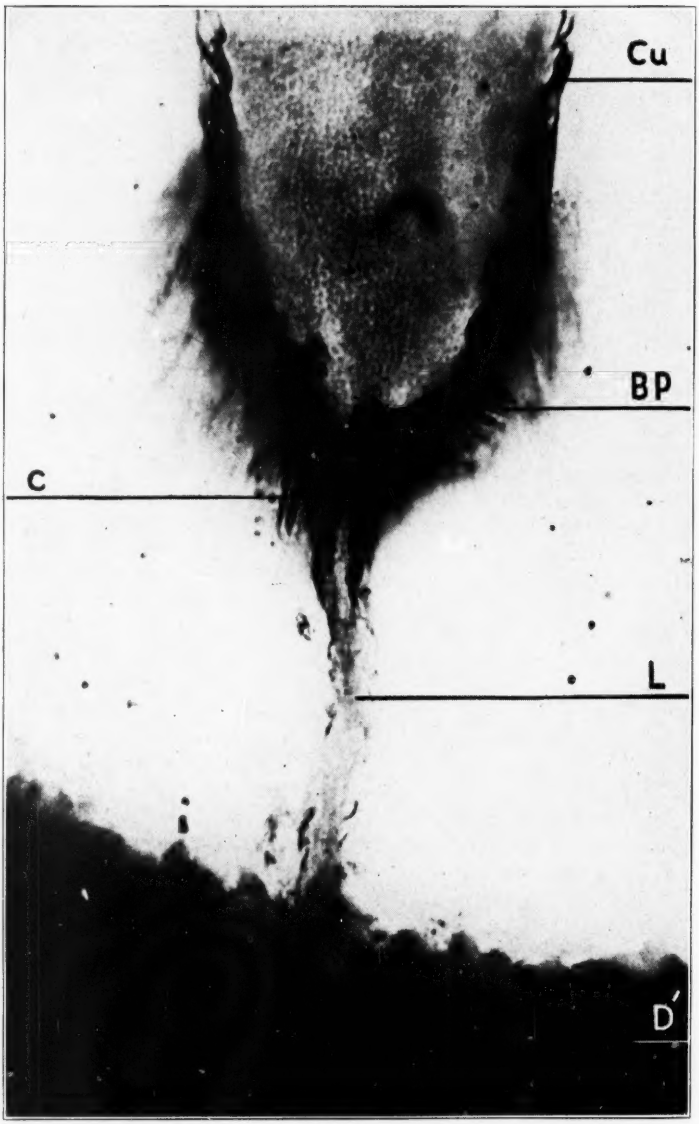


Fig. 11.—Higher magnification of Figure 10. *BP*, bottom of occlusal pit. *C*, caries of the enamel. *L*, enamel lamella. *D'*, infected and disintegrated dentin. *Cu*, enamel cuticle.

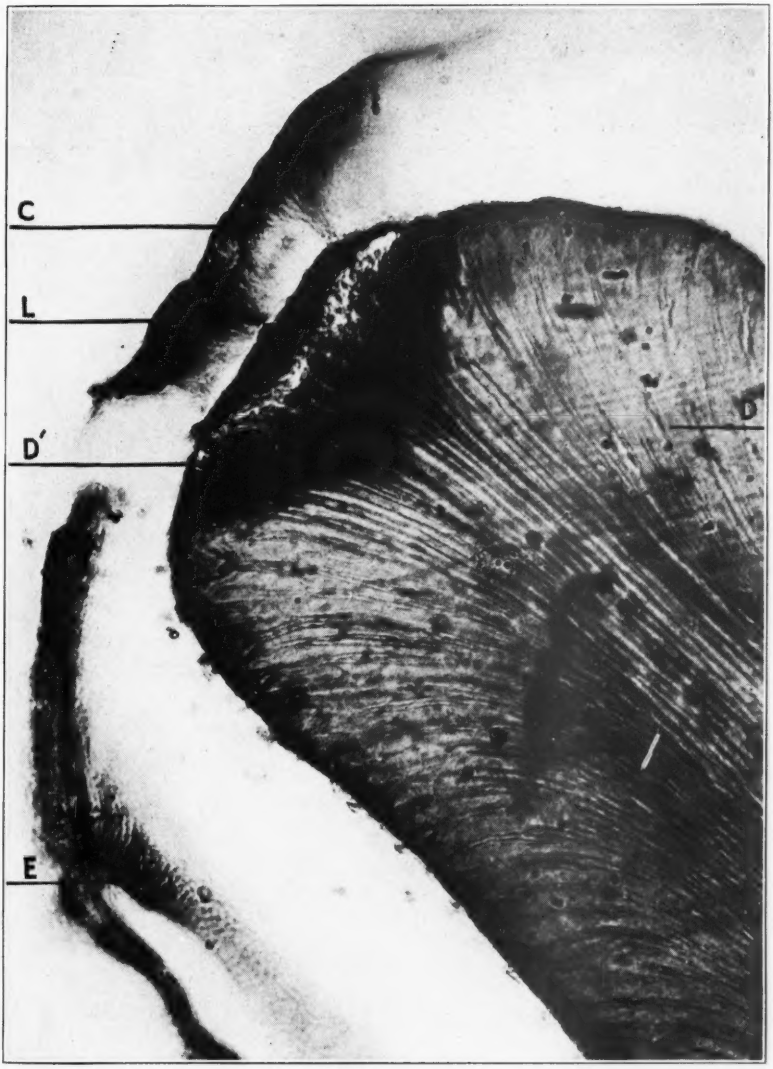


Fig. 12.—Caries of the cusp of a rat molar; decalcified section. *E*, enamel rests. *C*, caries of the enamel. *D*, dentin. *D'*, caries of the dentin. *L*, enamel lamellae.

stance, the result of the infection and disintegration of Tomes' fibers. The two on the right, *D*, appear to be normal. Tomes' fibers at *D* show as fairly thin

lines of tissue in the lumen of the tubuli, a condition due to postmortem shrinkage, as they almost fill the tubuli during life. In the center of the picture, the dentinal tubuli become much thicker on entering an interglobular space. In a few places, the fine anastomosing branches, *A*, are apparent. In other areas, caries has destroyed the entire matrix. At *C* is a globule of good calcification, and the dentinal tubuli which pass through it seem to be normal.

Fig. 13.—Ground section through an upper human bicuspid (unstained). *A*, jog in the dentin due to a disturbance during the development. *B*, stripes of Retzius. *C*, caries of the enamel. (×18.)

Euler and Meyer[9] show that the normal dentinal tubuli thicken slightly as they pass through an interglobular space. In cases of infected tubuli, this bulblike thickening is the beginning of the quick destruction of the surrounding matrix.

Up to this point, we have been dealing with the weak structures in the dentin through which caries may travel. We shall now consider the structures in the enamel which favor the progress of caries. These structures, as was mentioned in the beginning of the paper, are the enamel lamellae and the stripes of Retzius. Their importance was first pointed out by Gottlieb[9] in connection with his studies of the organic structures of the enamel.

The next two photographs, Figures 7 and 8, are taken from decalcified sections. Therefore, most of the enamel is gone, only shadow-like remains being left. The third microphotograph, Figure 9, is taken from a ground section. It is very important for the study of enamel lamellae to use both decalcified and ground sections. In the latter, the enamel is usually well preserved, and the structures and pathologic processes, such as lamellae and caries respectively, can be seen unchanged and in their proper places. The main

9. Euler-Meyer: "Pathohistologie der Zahne," 1927.

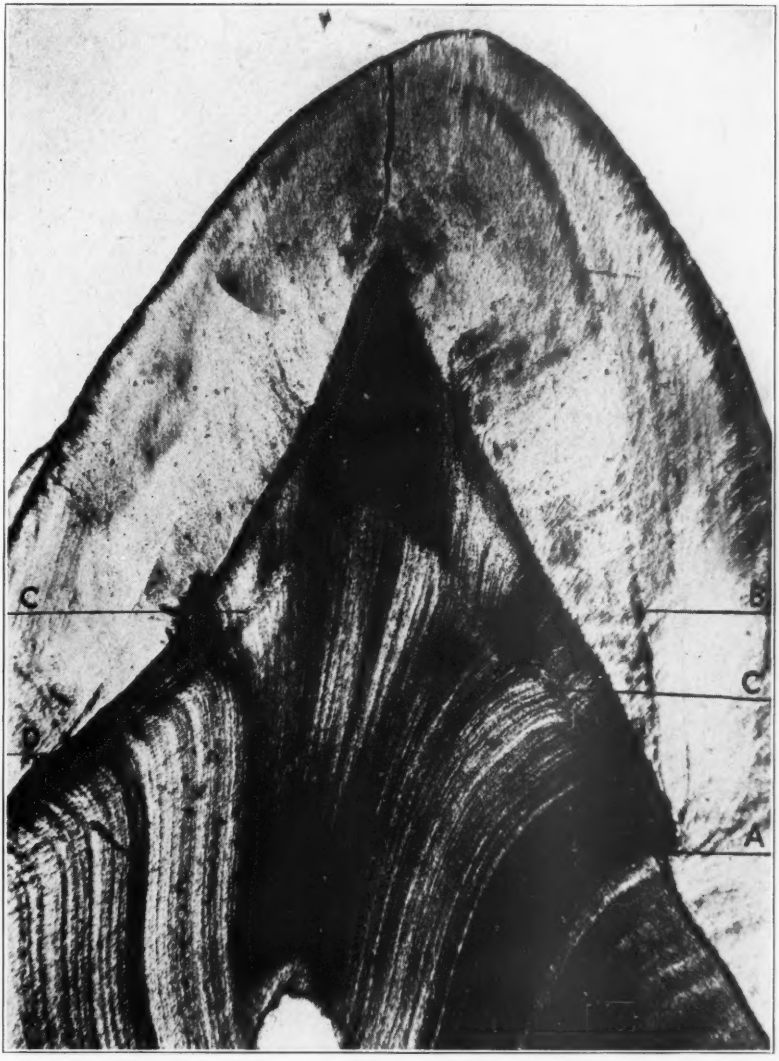


Fig. 14.—Higher magnification of the buccal cusp of the tooth shown in Figure 10. *A*, jog in the dentin probably due to a traumatic disturbance during the development. *B*, stripe of Retzius. *C*, border line between the dentin deposited before and after the disturbance. *D*, place corresponding to *A* on the right side of the cusp. (×35.)

Fig. 15.—Higher magnification of area *A*, Figure 11. *A*, jog in the dentin surface. *B*, point of development of the enamel at the time of the disturbance. *R*, stripe of Retzius. *E*, enamel formed previous to the disturbance. *E'*, enamel formed after the disturbance. *D*, dentin formed previous to the disturbance. *D'*, dentin formed after the disturbance. (×110.)

objection is the difficulty in discriminating between a lamellae and an artificial crack caused by the grinding. Therefore, decalcified and embedded sections must be studied. In a decalcified section, the enamel is gone and only part of the organic scaffold remains. The loss of the supporting calcified enamel sometimes results in the displacement and collapse of the organic structures, but this is the only means of studying these formations.

Figure 7 shows the progress of a rather superficial caries, located in the occlusal pit of a molar, along the enamel lamella, *L*, to the dentino-enamel junction. There, it spreads parallel to the dentin surface. This spread of decay along the dentino-enamel junction is the first step in the type of caries which undermines the enamel. The infection then progresses from the superficial area *C'* through the dentinal tubuli *D* to the interglobular spaces, *IG*.

In Figure 8, which was taken from the bottom of a fissure, the center of destruction is located in a deeper layer of the enamel and evidently originated in the lamella, *L*. At the dentino-enamel junction, the caries spreads horizontally much farther than in the former picture. Beneath this area of decay, infected dentinal tubuli may be seen, some of which show infected terminal ramifications (*D*). The infection then spreads to the interglobular spaces by means of these tubuli, which then thicken and disintegrate. This is seen at *IG*.

In ground sections, the importance of the lamellae to the spread of caries may often be observed. Figure 9, showing a typical case of this, was taken from a horizontal ground section through a human bicuspid. The enamel of this section contains caries of that type which slowly progresses ,parallel to the tooth surface, and is clinically characterized by brown marks with small loss of tooth structure. Histologically, about two thirds of the thickness of the enamel shows a dark brown color and an evidence of transverse striation. Separate enamel lamellae, *L*, are found running from the tooth surface to the dentino-enamel junction. At the end of each lamella, there is a fairly large brown area of beginning decay, *D'*, in the dentin. This picture resembles the one shown by Gottlieb[7] in his paper on dental caries, and is an evidence that, where caries develops slowly and superficially on the enamel surface, the lamellae are avenues by which it may pass into the dentin.

In the same paper, Gottlieb[7] showed that the presence of lamellae is not the only factor in the occurrence of caries in the enamel. He emphasized the importance of the hornified cuticle as a means of protecting the entrance of these lamellae. This condition was proved by Orban,[8] who was also able to show the occurrence of complete hornification at the entrance of a lamella. The importance of both enamel lamellae and the hornified cuticle is a good example of the error of considering the caries problem from merely one point of view. It is also a mistake to study exclusively either tooth structures or the influence of diet on the teeth.

The relation between lamellae and the progress of caries has been seen not only in human teeth but also in the teeth of animals. The following photomicrographs show conditions in the molars of a white rat very similar to those shown in Figures 7 and 8. Figure 10 shows the bottom of a central fissure of a rat's molar. This was a decalcified section, and, therefore, the enamel was lost, but owing to the embedding of the section in celloidin, the conditions in the fissure can

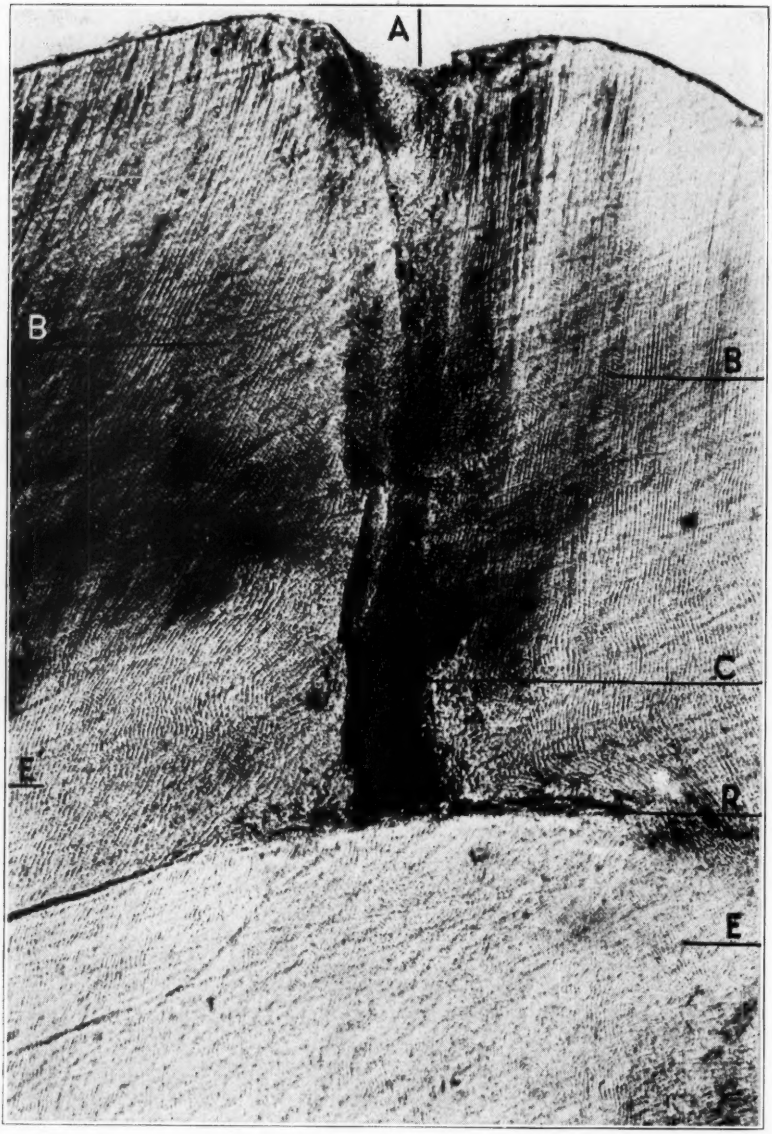


Fig. 16.—Higher magnification of area *C* on the lingual cusp of the tooth shown in Figure 10. *A*, loss of enamel substance on the tooth surface. *B*, enamel showing brown color and transverse striation. *C*, caries of the enamel. *R*, stripe of Retzius. *E'*, poorer calcified enamel. *E*, better calcified enamel. As the caries of the enamel reaches the stripe of Retzius, *R*, it spreads along the surface of the more resistant layer of enamel, *E*. (×60.)

be plainly seen. The bottom of the occlusal pit (*BP*) is full of débris, and superficial caries of the enamel starts from this point. An enamel lamella, *L*, runs from the deepest point of the fissure to the dentino-enamel junction. From the point where the lamella reaches the dentin, extensive caries spreads on each side along the dentino-enamel junction and into the dentin. The deepest point of the caries in the dentin is directly beneath the base of the lamella. The infection can be seen following the dentinal tubuli, *DT*, as already described in Figures 7 and 8.

A higher magnification of the bottom of the fissure is seen in Figure 11. This shows the organic mass of the lamella, *L*, extending from the bottom of the occlusal pit to the dentino-enamel junction. This indicates the route by which the bacteria reached and destroyed the dentin. The enamel shows only very superficial caries.

The following photomicrograph (Fig. 12) was also taken from a rat's molar. Here, the caries was found at the tip of a cusp. From a superficial caries of the enamel, *C*, a lamella, *L*, can be seen leading to a large area of destruction in the dentin. The dentinal tubuli, *D'*, in the area of infection, appear larger and finally disappear entirely toward the dentino-enamel junction, the dentin being changed into a structureless mass. These findings in molars of rats are another proof of the importance of the organic structures that are a part of the normal enamel.

The susceptibility of enamel to caries varies not only from its surface to the dentino-enamel junction, but also in the different planes parallel to its surface or parallel to the stripes of Retzius. In studying ground sections, an interesting example of this was found in an upper bicuspid of unknown history. The stripes of Retzius can be seen in both cusps in Figure 13. Usually, the relation of these stripes to the changes that occurred in early youth cannot be found. In this case, conclusions concerning the origin and significance of some of the stripes of Retzius are evident. The dentin of this tooth shows a condition that can be explained only as the result of a disturbance in an early stage of development. Both cusps show the same disturbance. The right cusp alone will be considered here, as it was made clearer by the grinding.

Figure 14 shows a higher magnification of the right cusp. The dentinal tubuli change their course at a certain level, *C*, thus making a sharp border line between two layers of dentin. To the right, at *A*, is a small jog in the outline of the dentin, indicating that there was a displacement of the entire cap of dentin. On the left side at *D*, changes do not reach the deepest point of the dentin at the central fissure, which proves that the disturbance must have occurred before the two cusps, which are formed separately, were joined. Seemingly, trauma occurred at an early stage of the tooth's development, after which the two small caps of hard substance were forced out of place. Therefore, the dentin formation continued in another direction. This disturbance may have been caused by early extraction of a deciduous tooth.

A higher magnification of area *A* of Figure 14 is shown in Figure 15. The dentin *D*, formed before the time of the disturbance, is marked on the inner surface by a line which runs from *A* to the upper left corner of the photomicrograph. The dentin *D'* was deposited after the time of the disturbance. The variation in the directions of the dentinal tubuli can be plainly seen. The dark area of enamel, *E*, corresponds to the oldest dentin, *D*. The enamel ends at a point *B*

above the end of the dentin at *A*. This is due to the fact that enamel formation in the tooth germ is always slower than formation of the dentin. The dentin, therefore, is never completely covered by enamel. The enamel, *E'*, that developed later shows a difference in color from that at *E*, deposited before the disturbance, and thus there is formed a typical stripe of Retzius, *R*.

It should be expected that if the stripes of Retzius are actually different layers of calcification, the difference would also be apparent in cases of caries. In the ground section described above, there is beginning caries of the left cusp (Fig. 13, *C*). A higher magnification of this area (Fig. 16) shows an unusual condition. On the surface of the enamel at *A*, there is a slight loss of tooth substance. From there into the deeper layers, the brown shade of the enamel, the transverse striations of the enamel rods at *B* and beginning caries at *C* may be seen. The caries suddenly stops at the level *R* on the surface of a light and dense layer of enamel, *E*. Here, the caries evidently reached the borderline between poorly and well-calcified layers of enamel, *E'* and *E*, respectively. It shows a tendency to follow the course of the stripe of Retzius, *R;* that is, to spread horizontally along the surface of the better calcified enamel.

The study of the histology of the enamel indicates that the enamel itself is not a continuous homogeneous structure. Aside from the organic structures found in the enamel, its composition of different layers of calcification may prove to be of importance to the progress of dental caries.

## SUMMARY

1. In the dentin, caries usually follows Tomes' fibers.

2. In the interglobular spaces, we find a fast spreading decay parallel to the tooth surface. The globuli of calcification in these areas are often found to be free from disease.

3. In the enamel, caries passes from the surface of the enamel to the dentino-enamel junction by means of the enamel lamellae. At the dentino-enamel junction, the caries spreads parallel to the dentin surface, thus undermining the enamel.

4. The stripes of Retzius indicate the borderlines between the different enamel layers of calcification. Caries of the enamel, when passing from a poorly to a well-calcified layer, is stopped and is then inclined to spread parallel to the course of the stripes of Retzius.

## DISCUSSION

*Edward H. Hatton, Chicago, Ill.:* Not only is this a matter of interest to men who are engaged in the practice of preventive medicine, but it also should give considerable thought to the persons who have been suggesting that the tooth is constantly changing in substance and is not a virtually permanent structure, and as metabolic changes occur, mineral changes in particular, there is a change in the structure of the tooth. Parts of the tooth are apparently relatively stable, and they remain so; and the process of caries is *not* controlled by changes in the tooth's structure.

*Weston A. Price, Cleveland, Ohio:* I am interested in this paper from the standpoint of nutrition. It emphasizes, as few papers could in a better way, the need that the structure of the tooth shall be homogeneously good during its entire formative period. If for no other reason, I think we should stress definitely the urgent need that the dietary shall include those factors which will provide a constant and an equal stimulation in the deposition of calcium in the structure. That can be done not only by a study of the dietary from the standpoint of its classification, but also will, of necessity, require a careful chemical and biologic analysis of the dietaries in order that the proper vitamins, as

well as the minerals, may be present in the diet during the child's development.

*B. A. Murray, Denver, Colo.:* I note that there is a termination of the processes of caries at the line of Retzius. Does it ordinarily close off this caries process? In the last slide, it looked as if it came to the line of Retzius and then left it abruptly.

*H. G. Leonard, New York City:* Regarding the statement concerning the dark line shown in the tubules, to the effect that it was a line of infection: I presume that Dr. Barker has made decalcified sections and stains for bacteria in those tubules so that he knows that it is an infection. The section showing the breaks in the fissures and the effects of bacteria, or infection, getting through these fissures into the dentin, illustrates again the necessity in susceptible persons for treating these carious areas early, because certainly those fissures in persons who are susceptible lead to early changes in the dentin. There is a type of decalcification section which Dr. Barker has developed allowing a series of sections. I am wondering if Dr. Barker could not use that method to advantage in this type of work, because he would thus be able to get serial sections and could show whether these tubules that pass down to certain points and then seem to disappear, actually disappear or bend out of the plane of the section that was used.

*Theodore B. Beust, Louisville, Ky.:* I was interested in the slides showing advance in caries, especially the one of the bicuspid. I am of the opinion that the enamel of the bicuspid, in the picture showing the shadows cast by the opaque enamel, down to a certain point bordered by one of the striae of Retzius, was in no sense decayed or infected. In fact, I have seen a large number of similar sections of teeth that show no evidence of decay whatsoever, and I am satisfied that these teeth never would have decayed had they not been extracted. I adhere to the view of von Ebner and Caush, and I think Bödecker might agree with me, that the striae of Retzius are not evidences of enamel deposition but are lines of the tubes which permeate the enamel which have been severed in grinding the section. In fact, they lie on the surface of the section. That is a controversial point which should not be brought up here, but as Dr. Hopkinson asked me to discuss the paper, I wish only to express my opinion to that end.

*Dr. Barker (closing):* Answering Dr. Price, I will say that, in the laboratory, we correlate these findings by experiments made on the teeth of white rats on the same diet, although we do not know the history of the diet in the findings on human teeth. Dr. Murray mentions the termination of the processes of caries at the line of Retzius. That is not a common occurrence. In the particular slide that was shown, it happened to terminate in that way. There was a question asked by Dr. Leonard as to whether we made bacterial tests or not. We did not make bacterial tests in the ground sections, but we know from gram staining of dentin in decalcified sections that a normal Tome's fiber appears very light, lighter than the surrounding dentin; whereas infected and decomposed fibers stain dark blue and show an irregular structure. We found the same changes in the dentin in ground sections. Referring to the last picture that I showed with the dental infection in relation to the lines of Retzius, I should like to ask Dr. Beust for his explanation of this slide.

*Dr. Beust:* It appears to me that an area showing a congenital defect in the enamel has been severed in making the section. I do not think the enamel has decayed nor do I think it will ever decay. In my experience, the teeth that exhibit the opaque figures shown do not decay. I omitted to mention that the striae of Retzius can be stained through the pulp of the tooth. If an area so stained is sectioned, the striae appear stained and the intervening enamel remains white. This proves that the striae stand in communication with the dentinal tubuli.

*Dr. Leonard:* I was not quite satisfied with Dr. Barker's answer. I wonder if these tubules have been stained for bacteria so that the bacterial bodies are recognized as such and not just dead tubules and spaces filled with stain. When you speak of those tubules as being infected, do you know they are infected?

*Rudolf Kronfeld, Chicago, Ill.:* May I make a statement about the staining? W. Meyer has shown some specimens in which he was able to stain the body of the bacteria themselves in the infected carious dentin of decalcified teeth.

# A SPECIFICATION FOR INLAY CASTING WAX*

By N. O. TAYLOR†, Ph.D., GEORGE C. PAFFENBARGER†, D.D.S., and W. T. SWEENEY‡, A.B., Washington, D. C.

INLAY casting waxes are a very important link in the chain of materials necessary to the production of cast gold inlays. The use of wax patterns in preparing intricate castings has been known for centuries, and we find Cellini, in his autobiography, describing the employment of waxes in the production of statues as early as the sixteenth century.

The history of the more recent adaptation of waxes to the process of making cast gold inlays is familiar to all members of the dental profession. Many methods for the production of inlays have been advocated in recent years, but, in the majority of cases, little or no attention has been paid to the properties of the waxes used.

This study was undertaken (1) to study the requirements of wax patterns for use in the inlay; (2) to determine the physical properties of the waxes now sold to the dental profession, and (3) to outline tentative requirements for this type of material as a specification for the American Dental Association.

## THE USE OF INLAY CASTING WAX

In the direct inlay process, wax patterns are produced directly in the cavity which has been prepared in the tooth. Wax is warmed until it is sufficiently plastic to flow under finger pressure. It is then forced into the cavity and held under pressure until it has cooled sufficiently to become rigid. The wax is then carved until the pattern is the shape desired to restore the tooth properly and, after polishing or burnishing, is removed from the mouth.

This procedure, if properly carried out, should give a wax pattern which is the exact size of the cavity at mouth temperature. This pattern will change dimensions slightly and shrink as it cools from mouth to room temperature. The extent of this dimensional change is dependent on the composition of the wax and on the room temperature.

The chief problem in making inlays to the dimensions of the cavities they are designed to fit lies in the development of practical methods which will enable the dentist to start with the slightly undersized pattern and to produce, by various manipulations of the wax or investment materials which enter into the process, a mold which is, at the casting temperature, sufficiently large to compensate for the

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*Cooperative research by the National Bureau of Standards and the American Dental Association.

*Publication approved by the director of the Bureau of Standards of the U. S. Department of Commerce.

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1.25 per cent casting shrinkage of the gold used to make the inlay.

This production of an enlarged mold could theoretically be carried out by the use of a wax pattern which could be expanded thermally to a sufficient degree to compensate for the gold shrinkage, or by the use of an investment compound with a sufficiently high thermal expansion to accomplish the same result.

Practically, it is found that inlay waxes which soften at temperatures which enable them to be used in the mouth are too

Fig. 1.—Automatic micrometer used to determine the flow of waxes under pressure. Total weight on samples was 2,000 gm.

plastic at high temperatures to permit the use of their thermal expansion properties as the only factor in compensating for gold shrinkage. The current commercial investments, on the other hand, do not have sufficient thermal expansion to permit their being used to offset completely the shrinkage of the gold. Recent developments indicate that investments which have sufficient thermal expansion to compensate for the casting shrinkage of gold will soon be on the market.

The better methods now advocated for making cast inlays employ a combination of wax expansion and investment expansion to make the processes successful. Unfortunately, few data on the characteristics of the individual waxes or investments have been available to the dental profession in the past, and many processes have been classed as failures on account of the variations between the properties of the materials used by the various workers.

The indirect inlay process makes use of pattern waxes in much the same manner as the direct process, with the exception that the pattern is adapted to a model instead of the cavity in the tooth. The model may be either larger or smaller than the tooth itself, the comparative size being dependent on the methods and materials employed in construction; and so the amount of compensation necessary for the latter stages of the casting process may vary.

## DESIRABLE PROPERTIES IN INLAY WAXES

A consideration of the methods of preparing patterns and of the subsequent steps in the casting process indicates that the following general characteristics are desirable in inlay casting waxes: 1. The waxes should soften without becoming flaky or laminated. 2. They should be sufficiently plastic at temperatures slightly above mouth temperature to permit forcing them into all the details of the cavity walls. 3. They should harden sufficiently at mouth temperature to permit withdrawal from the cavity without distortion. 4. They should carve without chipping and flaking. 5. The color should be such that it facilitates the carving of the pattern in the mouth through con-

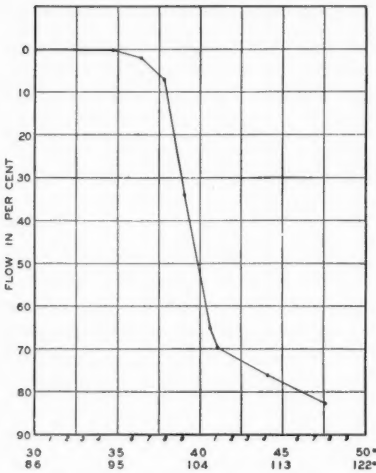


Fig. 2.—Flow of inlay wax No. 1.

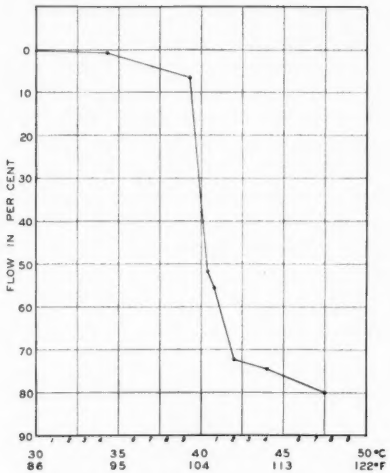


Fig. 3.—Flow of inlay wax No. 2.

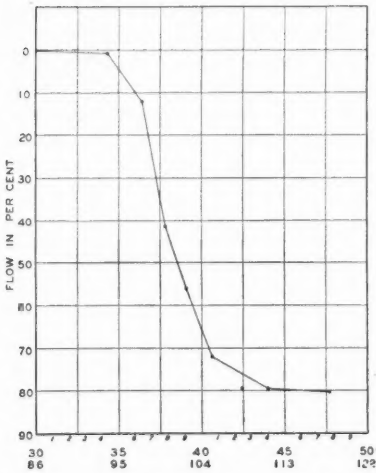


Fig. 4.—Flow of inlay wax No. 3.

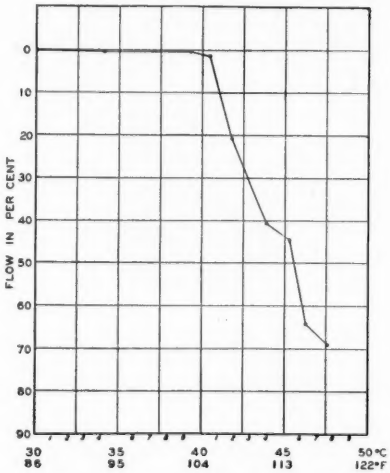


Fig. 5.—Flow of inlay wax No. 4.

trast with the hard and soft tissues of the mouth. 6. The thermal expansion characteristics should be known to insure the correct use of the material in any technic requiring wax expansion.

PHYSICAL PROPERTIES OF INLAY WAXES

Samples were obtained of twelve commercial inlay waxes and determinations made of their physical properties.

The colors of these waxes were, for

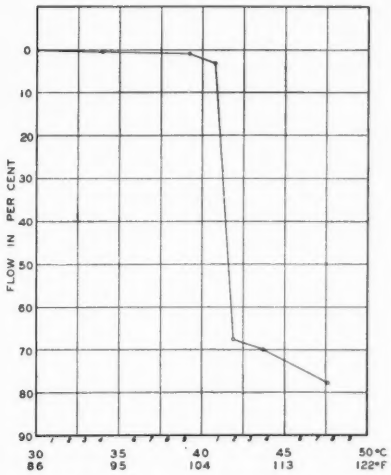


Fig. 6.—Flow of inlay wax No. 5.

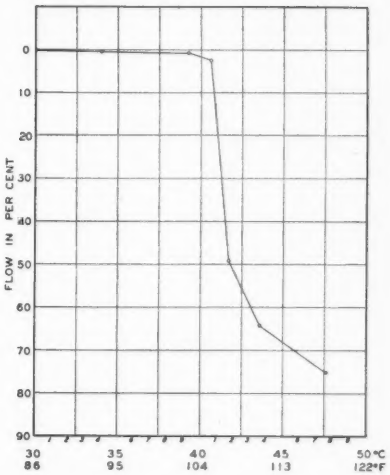


Fig. 7.—Flow of inlay wax No. 6.

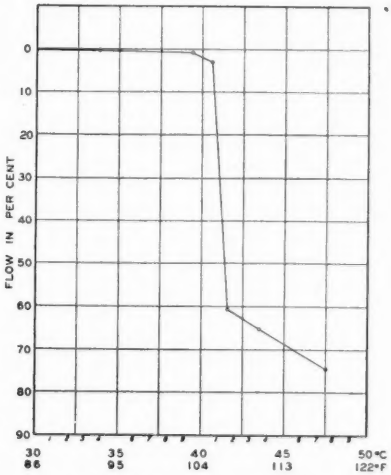


Fig. 8.—Flow of inlay wax No. 7.

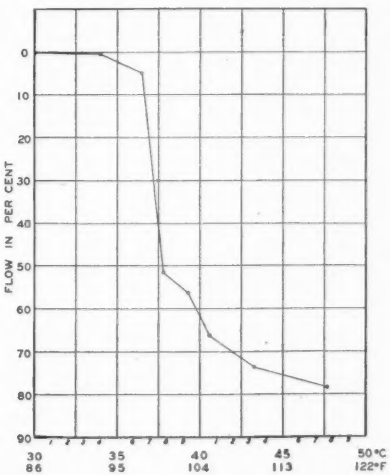


Fig. 9.—Flow of inlay wax No. 8.

the most part, blue or green, with a tendency toward the darker shades. This is in line with the apparent preference of the dental profession as evidenced by replies to questionnaires, which indicated a general preference for dark greens and blues for inlay waxes.

Samples were flamed and softened and observations made on the behavior of the waxes during the process. With the

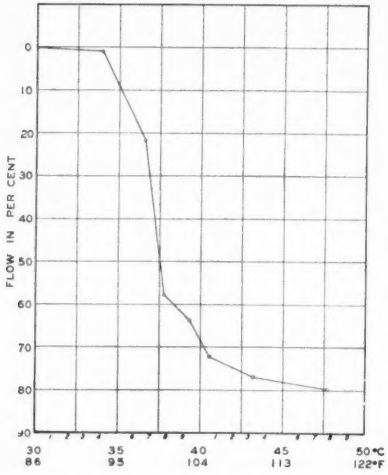


Fig. 10.—Flow of inlay wax No. 9.

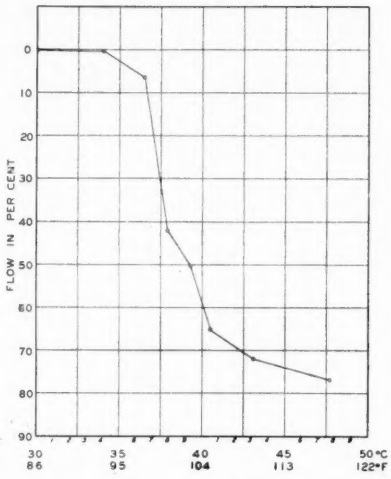


Fig. 11.—Flow of inlay wax No. 10.

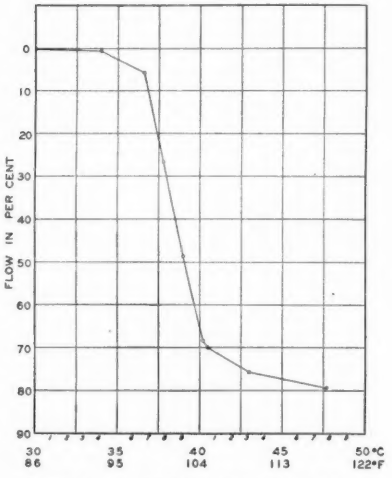


Fig. 12.—Flow of inlay wax No. 11.

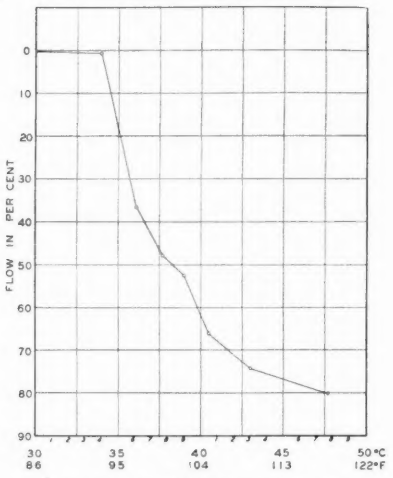


Fig. 13.—Flow of inlay wax No. 12.

exception of waxes known to be high in carnauba, the samples tested softened satisfactorily in the flame and assumed a workable plasticity without noticeable flaking.

The softening points of the waxes as well as data on their plasticity at various temperatures were obtained in a series of flow tests. Samples 1 cm. in diameter and 6 mm. thick were placed in an automatic

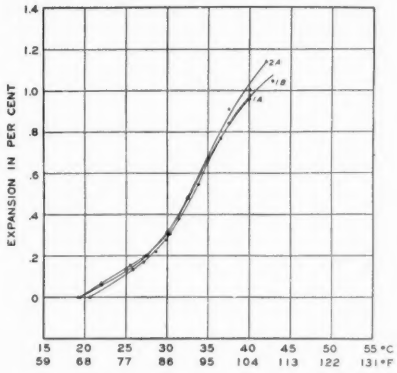


Fig. 14.—Thermal expansion of inlay wax No. 1. *1A*, first run on sample No. 1; *1B*, second run on sample No. 1; *2A*, first run on sample No. 2.

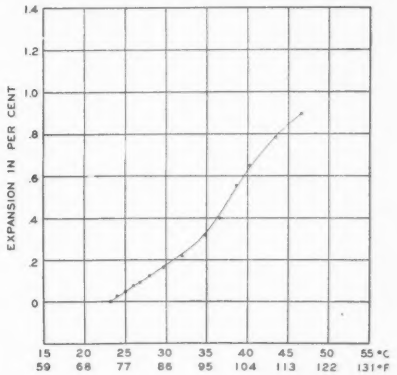


Fig. 15.—Thermal expansion of inlay wax No. 2.

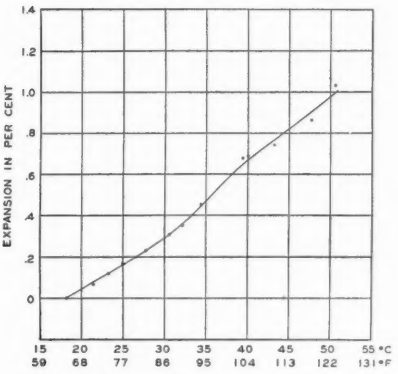


Fig. 16.—Thermal expansion of inlay wax No. 3.

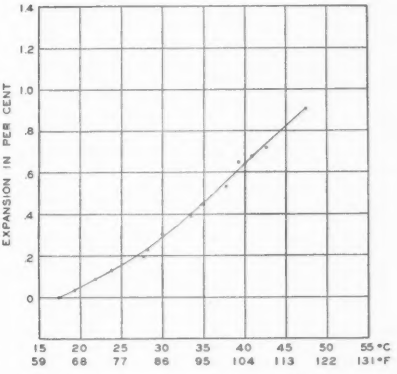


Fig. 17.—Thermal expansion of inlay wax No. 4.

micrometer (Fig. 1) under a constant pressure of 2,000 gm. and under known temperature conditions. Temperatures were varied from 35 C. (95 F.) to 50 C. (122 F.). The percentage of flow under these conditions was determined at the end of ten minutes. The data obtained are to be found in Table I and are shown graphically in Figures 2 to 13 inclusive. Comparison of the flow values and practical observations on the proper plasticity for use in the mouth indicated that the value for flow in percentage for any wax should be between 50 and 60 for satisfactory work. The softening points were easily determined from the curves and it is apparent that the majority of the waxes studied softened at points too low to permit them to be considered as satisfactory for practical use. The majority of the

PHYSICAL PROPERTIES

| Sample No. | Color | Manufacturer's Description | Flow* Per Cent | | | | | | | Softening Point from Flow Curve† (Centigrade) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 32.5 C. (90.5 F.) | 35.0 C. (95.0 F.) | 37.5 C. (99.5 F.) | 40.0 C. (104.0 F.) | 42.5 C. (108.5 F.) | 45.0 C. (113.0 F.) | 47.5 C. (117.5 F.) | |
| 1 | Dark blue | Inlay casting wax (regular) | 0.2 | 0.5 | 6.0 | 53.0 | 73.0 | 78.0 | 82.5 | 37 |
| 2 | Light green | Special casting wax | 0.5 | 1.5 | 4.5 | 36.0 | 73.0 | 76.0 | 80.0 | 38 |
| 3 | Dark blue | Inlay wax, blue hard | 0.6 | 4.5 | 35.0 | 65.5 | 76.0 | 80.0 | 80.5 | 36 |
| 4 | Bright dark green | Inlay wax green extra hard | 0.2 | 0.4 | 0.5 | 1.0 | 27.5 | 44.0 | 68.5 | 41 |
| 5 | Medium green | Green wax | 0.4 | 0.6 | 0.8 | 2.0 | 68.5 | 72.5 | 77.5 | 41 |
| 6 | Purple | Improved inlay wax, hard | 0.4 | 0.6 | 0.8 | 1.5 | 55.5 | 68.0 | 75.0 | 41 |
| 7 | Dark blue | Improved inlay wax, medium | 0.3 | 0.4 | 0.6 | 2.0 | 63.0 | 69.0 | 74.5 | 41 |
| 8 | Light blue | Inlay wax—blue | 0.4 | 2.5 | 41.0 | 62.0 | 71.5 | 75.5 | 78.0 | 36 |
| 9 | Light green | Medium inlay wax | 0.7 | 9.0 | 49.0 | 68.5 | 76.0 | 78.0 | 80.0 | 36 |
| 10 | Greenish black | Stiff inlay wax | 0.4 | 2.5 | 31.5 | 59.0 | 70.5 | 74.0 | 77.0 | 36 |
| 11 | Black | Inlay wax | 0.4 | 2.5 | 21.5 | 65.5 | 75.0 | 77.5 | 79.5 | 36 |
| 12 | Medium green | Inlay wax | 0.5 | 18.5 | 46.5 | 61.5 | 72.5 | 77.0 | 80.0 | 35 |

*Samples 10 mm. diameter and 6 mm. long; load, 2,000 gm.; time of test, ten minutes.
†Flow exceeds 5 per cent.

waxes were too plastic at mouth temperature to allow patterns to be handled without danger of distortion.

Accurate cooling curves were obtained on the waxes from the molten condition to room temperature. The data obtained were of little value in determining the hardening point of the waxes, since the waxes have considerable plasticity after the solidification process is complete.

The thermal expansion curves of the waxes were obtained by floating samples 250 mm. long slightly below the surface of a water bath and noting the changes in length with comparator microscopes as the temperature of the bath was increased. These curves are shown in Figures 14 to 25. The samples showed tendencies to warp when the temperatures were increased much above mouth temperature. The thermal expansion rates of the waxes showed gradual increases with increases in temperature until the materials started to soften. From the softening point, the expansion rates as shown by this method start to decrease, and this point may be

OF INLAY WAXES

| Working Range from Flow Curve ‡ (Centigrade) | Thermal Expansion Per Cent | | | | | Limit of Safe Range for Thermal Expansion# (Centigrade) | Comment |
|---|---|---|---|---|---|---|---|
| | 20 to 25 C. (68 to 77 F.) | 25 to 30 C. (77 to 86 F.) | 30 to 35 C. (86 to 95 F.) | 35 to 40 C. (95 to 104 F.) | 40 to 45 C. (104 to 113 F.) | | |
| 40–41 | 0.128§ | 0.180 | 0.364 | 0.302 | 0.184§ | 39 | Flakes considerably on carving; almost too soft for direct inlay work |
| 40–41 | 0.128§ | 0.128 | 0.156 | 0.294 | 0.222 | 41 | Flakes considerably on carving |
| 38–39 | 0.116 | 0.130 | 0.160 | 0.200 | 0.154 | 39 | Too soft for direct inlay work; very satisfactory for indirect work |
| 45–46 | 0.108 | 0.134 | 0.170 | 0.184 | 0.182 | 43 | Too hard and brittle. Flakes badly in carving; considered impractical for inlay work direct or indirect |
| 41–42 | 0.108 | 0.116 | 0.144 | 0.252 | 0.258 | 42 | One of the superior waxes; does not chip or flake on carving or scraping; softens at a few degrees above mouth temperature |
| 42–43 | 0.124 | 0.096 | 0.108 | 0.156 | 0.212§ | .. | Has practically the same properties as No. 5, but slightly harder |
| 41–42 | 0.152§ | 0.156 | 0.150 | 0.260 | 0.266 | 43 | Very similar to No. 5 |
| 38–40 | 0.106§ | 0.136 | 0.298 | 0.252 | 0.102 | 37 | Softens at too low a temperature for direct inlay work |
| 37–38 | 0.116 | 0.160 | 0.260 | 0.170 | 0.100 | 36 | Considered very unsatisfactory because of its low softening point |
| 39–40 | 0.158§ | 0.160 | 0.330 | 0.232 | 0.140§ | 36 | Very similar to No. 8 |
| 39–40 | 0.108§ | 0.132 | 0.296 | 0.284 | 0.286 | 38 | Very similar to No. 8 |
| 38–40 | 0.164§ | 0.244 | 0.372 | 0.228 | 0.140 | 35 | A very unsatisfactory wax because of low melting point |

‡Flow is between 50 per cent and 60 per cent.
#Point at which the rate of expansion starts to decrease.
§Estimated from curve.

taken as an indication of the upper limit to which the waxes can be safely carried in any wax expansion technic.

Figure 15 contains three curves obtained on the same material. Two of these curves represent the type of checks obtained by making duplicate determinations on two different samples of the same material. The third curve shows the results obtained by allowing a sample of the material to cool and then making a second determination.

The accompanying table gives the data obtained on the physical properties of waxes.

### DISCUSSION OF DATA OBTAINED

The tests made to determine the flow of waxes under pressure showed definitely that half of the waxes tested softened below mouth temperature. Waxes 3, 8, 9, 10, 11 and 12 were in this group. It appears that these waxes would be of doubtful value in practice. The lack of

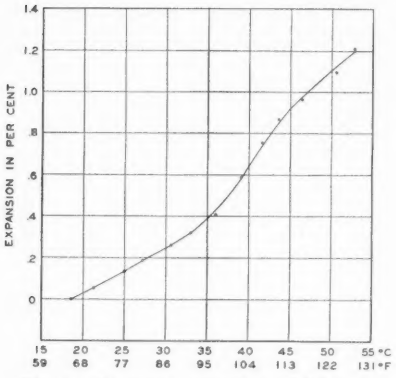


Fig. 18.—Thermal expansion of inlay wax No. 5.

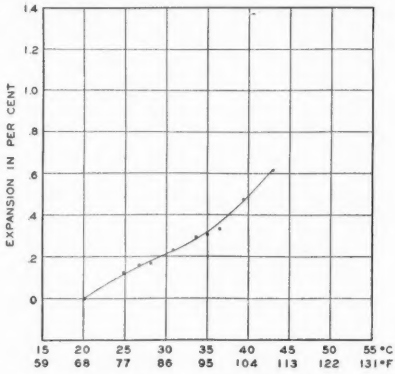


Fig. 19.—Thermal expansion of inlay wax No. 6.

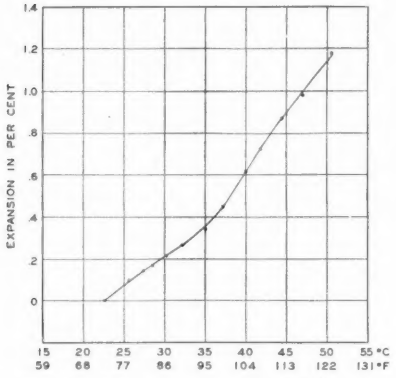


Fig. 20.—Thermal expansion of inlay wax No. 7.

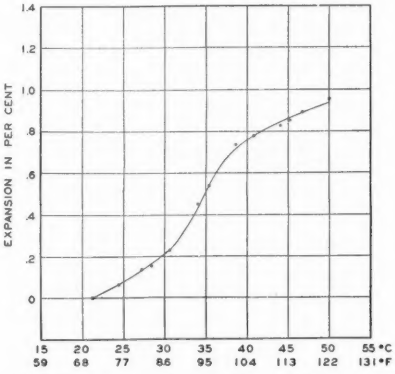


Fig. 21.—Thermal expansion of inlay wax No. 8.

rigidity at mouth temperature would make it possible to distort patterns very easily. The low softening points would also lead to distortion of patterns in any wax expansion technic.

Wax No. 1 starts to soften at mouth temperature. It may be that this wax has sufficient rigidity at 37 C. for all practical purposes as far as removal of the pattern is concerned, but it does appear that it is too soft to warrant its use in a wax expansion process.

Wax No. 4 was the one wax in the group which seemed definitely too hard. It started to soften at 41 C. but did not become sufficiently plastic to work well until heated to 45 C. or 46 C. It would be difficult to keep this material in its working range long enough to assure an accurate copy of the details of the cavity.

Waxes 2, 5, 6 and 7 make up a group which soften above mouth temperature and, at the same time, are plastic in ranges fairly close to mouth temperature.

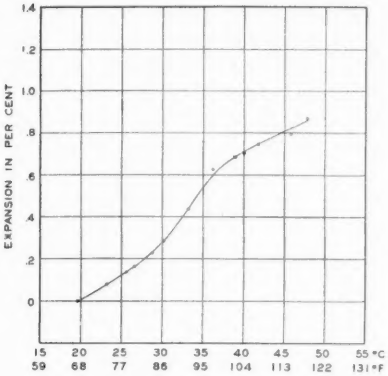


Fig. 22.—Thermal expansion of inlay wax No. 9.

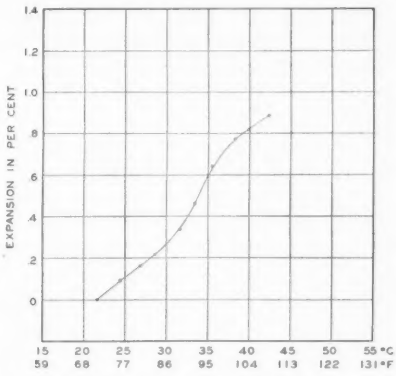


Fig. 23.—Thermal expansion of inlay wax No. 10.

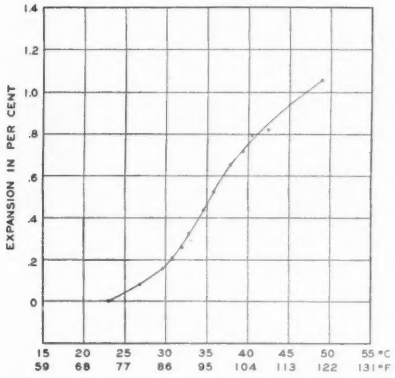


Fig. 24.—Thermal expansion of inlay wax No. 11.

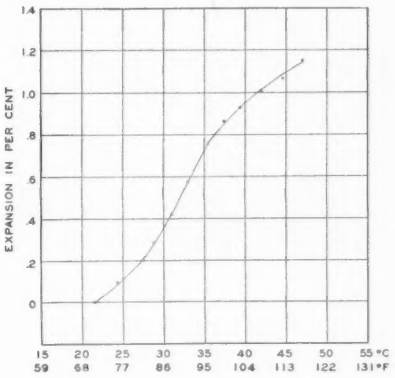


Fig. 25.—Thermal expansion of inlay wax No. 12.

Wax No. 2 softens at about 39 C. and the others at 41 C. Nos. 5 and 7 are very similar in all their characteristics although they are made by different manufacturers. No. 6 is very similar to Nos. 5 and 7, with the exception that its working range is about 1 degree higher. These waxes appear to be of better quality for all-round use than the others tested. They are sufficiently rigid at mouth temperature, soften quickly and become plastic at ranges which permit satisfactory use in the mouth.

Figure 26 shows a series of wax samples which have been subjected to the flow test. The waxes range from No. 12 at the left, it being the softest wax in the group, through No. 8, a slightly harder wax but still too soft; No. 1, which softens at very close to mouth temperature; No. 2, which softens sharply at just above mouth temperature; No. 5, which, through its

rigidity at mouth temperature and rapid softening, is considered one of the most satisfactory of inlay waxes, to No. 4 at the right, which is definitely too hard for general use.

Five samples of each wax are shown, the approximate temperatures at which they were subjected to pressure being 34 C. (93.2 F.), 36.5 C. (97.7 F.), 39 C. (102.2 F.), 42 C. (102.6 F.) and 47.5 C. (117.5 F.), from top to bottom. An examination of the photograph makes comparison of these types of waxes easy and shows definitely the characteristics of the various grades. The softer waxes are appreciably plastic below mouth temperature, while the better types, as evidenced by sample No. 5, show marked rigidity at mouth temperature, followed by a rapid softening at slightly above 40 C.

The values given in the tabulated data for softening point and for working range are estimated from the plotted curves. Waxes were considered to have softened appreciably when the flow became greater than 5 per cent, and the working range was taken as the temperature range within which the flow was between 50 and 60 per cent.

The thermal expansion characteristics of waxes must be known if proper use is to be made of the materials in any wax expansion process. Wax expansion is usually relied on to compensate for part of the contraction of the casting gold and the thermal expansion of the investment utilized to compensate for the balance of the shrinkage. The greater rigidity and resistance to distortion of the stronger investment compounds would indicate that all the expansion possible should be obtained through their thermal expansion, as little expansion as practically possible being left to be obtained through wax expansion. Few of the casting technics advocated at present have given any consideration to the fact that the wax patterns are very susceptible to distortion, and most of them are forced, by their choice of investments, to expand their wax patterns beyond the limits of the safe working ranges.

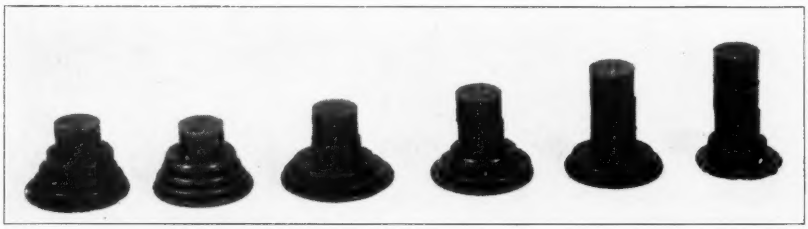

Fig. 26.—Results of flow tests on inlay waxes, samples (left to right) 12, 8, 1, 2, 5, 4; test temperatures approximately 34 C. (93.2 F.), 36.5 C. (97.7 F.), 39 C. (102.2 F.), 42 C. (107.6 F.), 47.5 C. (117.5 F.).

All of the common methods of wax expansion (air bath, water bath and hot investment methods) are open to considerable criticism as they are ordinarily practiced. Even the harder waxes become plastic at the temperatures advocated for their expansion. Distortion and inac-

curacies can be eliminated to a large extent by limiting the amount of wax expansion required to the minimum and by choosing a wax with a high softening point. Indirect methods permit greater wax expansion as the patterns are formed at lower temperatures and may be safely expanded over wider temperature ranges.

The waxes tested in the laboratory were submitted to a group of representative members of the dental profession. This group made practical tests of the waxes, and the results of their work have substantiated the laboratory findings. We find, for example, that all those who reported on waxes No. 5 and No. 7 considered them of first quality. Wax No. 4 was universally considered too hard, while some workers also considered No. 6 too hard. Wax No. 1, which we have previously mentioned as softening just at mouth temperature, was generally considered as unsatisfactory. The soft waxes were generally reported as unsatisfactory, although several workers noted that these materials would be satisfactory in the indirect processes.

The tabulated data indicate the general working characteristics of the various waxes as determined in the laboratory and by the cooperative committee. These characteristics cannot be accurately measured and are based upon the comments made by individual workers.

## SUGGESTED REQUIREMENTS FOR INLAY WAXES

No standard has been set for inlay waxes in the past other than the requirements of the individual manufacturer, which, of course, applied only to his own product. This fact has made it impossible to compare the properties of the waxes studied with a set standard or specification. The data obtained in the study were used as a basis for the following.

## AMERICAN DENTAL ASSOCIATION SPECIFICATION NO. 4. TENTATIVE SPECIFICATION FOR DENTAL INLAY CASTING WAX

(Approved July 24, 1930)

I. 1. This specification is for the waxes used as patterns in the production of cast gold inlays. They are essentially waxes and hydrocarbons of the paraffin series. 2. The wax may be furnished as sticks or cones.

II. Material: The wax shall be uniform in quality and free of foreign material.

III. General Requirements: Waxes shall possess the following features: 1. The color shall be such as to facilitate the carving of patterns through contrast with the hard and soft tissues of the mouth. 2. The materials shall soften without becoming flaky. 3. The materials shall trim to a fine margin without appreciable chipping or flaking. 4. The materials shall be capable of being melted and vaporized without leaving solid residues other than carbon.

IV. Detail Requirements: 1. Flow at mouth temperature. Samples 1 cm. in diameter shall not shorten more than 1 per cent in length when subjected to a load of 2,000 gm. for ten minutes at 37.5 C. 2. Softening point. The softening point of the material shall be between 38 and 42 C. 3. Working Range. The material shall soften sharply and a working plasticity shall be obtained at or below 43 C. 4. Thermal expansion. A curve or numerical data shall be supplied with the material which will enable the purchaser to make the proper use of the material in technics requiring wax expansion.

V. Methods of Test: 1. Flow at mouth temperature. Specimens shall be cylinders 10 mm. in diameter and 6 mm. in length. The ends shall be surfaced plane at right angles to the axis. Samples shall be maintained at the testing temperature for at least twenty minutes prior to testing. A load of 2,000 gm. shall be applied for ten minutes, the temperature being maintained at 37.5 C. The change in length shall be calculated in percentage of original length. 2. Softening point. The softening point shall be determined from a curve obtained by plotting values for percentage of flow as obtained by the method outlined in V-1, against variations in temperature. The material shall be considered to have softened when the flow exceeds 5 per cent. 3. Working range. The working range shall be considered the temperature range

within which the materials will exhibit a percentage of flow of from 50 to 60 when subjected to pressure as outlined in V-1. 4. Thermal expansion. The thermal expansion characteristics of the materials shall be determined by methods which will insure an accuracy of ± 0.05 per cent, up to the temperature at which warpage occurs.

VI. Packing: 1. The minimum net weight of the contents shall be indicated on all packages. 2. Each package shall be marked with a serial number or combination of letters and numbers which shall refer to the manufacturer's records for the particular lot of wax. 3. The date of manufacture (year and month) shall be indicated on the package as a separate item or as a part of the serial number.

VIII. Notes: 1. Manufacturers of waxes may indicate that their products comply with this specification by (*a*) a statement on the package guaranteeing the material contained therein to meet the requirements of this specification, or (*b*) a statement of the physical properties of the wax. In either case, thermal expansion data shall be supplied. 2. The American Dental Association will not assume responsibility for, or guarantee compliance of, materials so labeled by manufacturers, but will, in event of a dispute between a member of the Association and a manufacturer, act in an advisory capacity and will designate laboratories having equipment for testing waxes, where necessary tests may be made.

Preliminary copies of this specification were distributed to the manufacturers of inlay waxes, and they have been given an opportunity to certify their willingness to produce materials meeting the requirements of the specification. Some time is necessarily required to make minor changes in packages and labels, and the manufacturers were asked to indicate the latest date on which their product would meet all of the requirements. The certifications received prior to the publication date of this paper will be included in it.

Such packages of the following materials as were tested during the first half of the year 1930 were found to meet the requirements outlined above:

Dr. Peck's Blue Inlay Wax, A. E. Peck Mfg. Co.

Dr. Peck's Purple Inlay Wax, A. E. Peck Mfg. Co.

Taggart's Green, W. H. Taggart

This listing is alphabetical and no significance is to be attached to the order of listing.

Obviously, publication of this list must not be regarded as proof that all packages of the various brands sold during the first half of the year 1930 met the requirements; nor must it be regarded as proof that packages of these brands purchased subsequently will meet requirements. Guarantees of these conditions must be supplied by the individual manufacturers.

Undoubtedly, all wax manufacturers having proper testing facilities and accurate control of manufacture will immediately take steps to guarantee their products. The profession will in this manner be able to select inlay waxes which are suitable for use in the production of accurate restorations.

# A SPECIFICATION FOR DENTAL IMPRESSION COMPOUND*

By N. O. TAYLOR†, Ph.D., W. T. SWEENEY‡, A.B., and GEORGE C. PAFFENBARGER†, D.D.S., Washington, D. C.

IMPRESSION compounds find their chief dental uses in the production of impressions for prosthetic work and in orthodontia. A much smaller quantity of material is used in impressions in the various indirect processes of making cast gold inlays. The users of these materials have been considerably handicapped through the absence of any definite information as to the characteristics and quality of the various materials in this group as currently offered for sale.

In 1929, a considerable study was made of impression compounds and their use in the production of cast partial dentures. The publication of the paper on the partial denture process has been delayed pending the completion of further work in this field by a cooperative committee appointed from the dental profession. An outline of the original work has been published,[1] but work in the inlay field in the past year has made it appear advisable to combine the original data obtained on impression compounds with those obtained on these materials in the past few months and to present them at this time.

## PHYSICAL PROPERTIES OF IMPRESSION COMPOUNDS

A number of physical tests were made on eighteen varieties of impression compounds with the object of comparing their properties. The properties in question included softening point, hardening point, flow, tensile strength, shrinkage through the working range and other minor properties.

Several determinations of the softening point were made. The A. S. T. M. ring and ball test,[2] used in testing bituminous materials, was made on the compounds studied. A simple form of the apparatus used is shown in Figure 1. A small brass ring filled with compound is placed in a water bath and a small steel ball is placed on the center of the upper surface. The temperature is increased at the rate of 5 degrees centigrade per min-

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1. Taylor, N. O.: Progress Report on Research on Dental Materials (II). The Research Program, J.A.D.A., 17:775 (May) 1930.

2. A. S. T. M. Standards D36-26, 2:496, 1927.

ute. The compound softens and flows downward. The temperature of the bath at the instant the compound touches a surface 1 inch below the bottom of the ring is taken as the softening point.

Figure 2 shows a simple form of softening point testing equipment which will give interesting results in the comparison of various types of compound. A square bar of compound (¼x¼x2¼ inches) is suspended horizontally on a support one-quarter inch wide in a water bath. When the temperature is raised gradually (5 degrees centigrade per minute is fairly satisfactory), the bar sags and the temperatures can be recorded at which bending begins and when the angular sag is 30, 60 or 90 degrees. Slight variations in length of samples combined with the variation in amounts of filler in different compounds limit the usefulness of this simple test to elementary laboratory comparisons of materials.

A Shore durometer (Fig. 3) was also used to check the softening point of the various compounds. A small plunger under a definite pressure is brought in contact with samples of compound one-fourth inch thick and the amount of penetration occurring in thirty seconds noted.

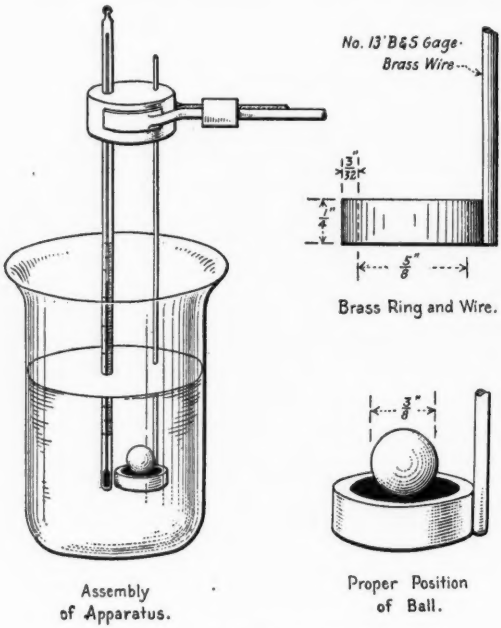


Fig. 1.—Apparatus for ring-and-ball method.

The scale is an arbitrary one reading from zero to 100. A series of readings were taken on compound samples whose temperatures were raised gradually (1 degree centigrade intervals, with ten minutes allowed for the compound to come to the required temperature), and the softening point recorded as that tempera-

ture at which the scale reading was 5 or more scale divisions from that next preceding it.

Samples of the various compounds were heated until very plastic. A copper-constantan thermocouple was inserted and a record made of the temperature and time relations existing during the cooling period.[3] Curves from these data showed a marked evolution of heat in every case

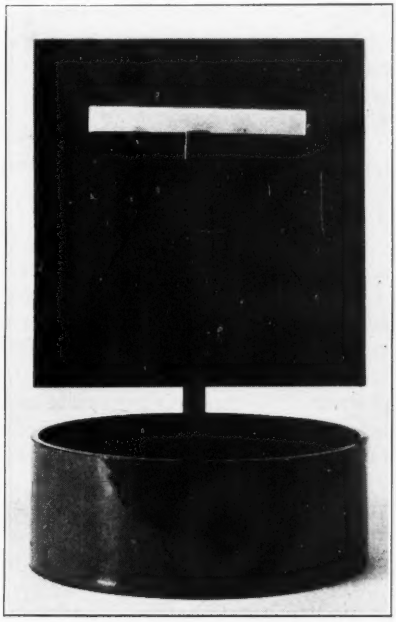

Fig. 2.—Simple form of equipment used in comparing the softening ranges of impression compounds.

and the temperatures at which this took place were recorded as the crystallization or hardening point of the materials.

3. Washburn, E. W.: Principles of Physical Chemistry, New York: McGraw-Hill Book Co., p. 359. Desch, C. H.: Metallography 14, New York: Longmans, Green and Company.

The resistance of six of the compounds to deformation under constant pressure was determined over temperature ranges from 35 to 55 C. (95 to 131 F.). Samples 10 mm. in diameter and 6 mm. long were subjected to a load of 2,000 gm. for ten minutes at the various temperatures. The curves obtained for these materials are given in Figure 4. Experience with the various laboratory tests for compounds indicates that this test is probably the best method of those considered for determining hardening or softening points and working range.

The tensile strengths of the compounds were determined. Small samples were

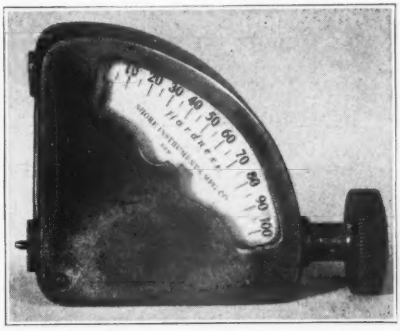

Fig. 3.—Shore durometer used to determine the softening point of impression compounds.

formed in a briquette mold (Fig. 5). These samples, which had a minimum cross-sectional area of 0.05 (one-twentieth) of 1 square inch, were broken in a pair of special grips by a dead load produced by the gradual addition of fine shot to a container suspended from the lower grip. A starting load of 10 pounds was applied and shot added at the rate of approximately 2½ pounds per minute. The tests were carried out at temperatures between 20 and 25 C. (68 to 77 F.), inclusive. Variations in temperature influ-

ence to a very marked degree the strength of this type of material, and temperatures should be very carefully controlled in making comparative tests of these materials.

The dimensional changes of compounds were observed by means of a comparator consisting of two micrometer microscopes. A preliminary form of the apparatus used is shown in Figure 6. Samples approximately 25 cm. long were heated slightly above 40 C. (104 F.),

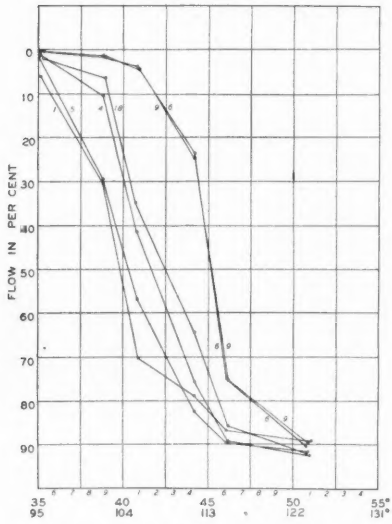


Fig. 4.—Flow of impression compounds under pressure; specimens 10 mm. diameter by 6 mm. long; load, 2,000 gm. Sample numbers refer to tabulated data.

the microscopes being focused on lines marked on small silver plates mounted on the compound. The temperature was decreased by small steps at intervals of thirty minutes or longer and the changes in length were recorded. The values reported indicate the shrinkages observed between 40 and 25 C. (104 and 77 F.).

A special committee of the District of Columbia Dental Society and representatives of the Army and the Navy dental schools assisted in a practical comparison of the compounds studied. This group have given data on the practical working ranges of the compounds and a classification of the materials into various groups, based on the results of their study of the behavior of the materials when flamed, trimmed and manipulated as they are ordinarily handled in dental practice.

A summary of the data obtained is given in the accompanying table.

## COMMENT ON RESULTS

The chief interest in the various physical tests lies in their practical usefulness in determining whether or not a compound will be satisfactory for use.

The ring and ball test is capable of separating the good and the fairly good compounds from the definitely poor ones, but does not differentiate within the group which contains both the satisfactory materials and others which may be of doubtful value. This test can be carried out quickly and easily and definitely detects the materials with high softening and working ranges.

The determination of the softening point of compounds by use of the durometer is a slow process, and the results obtained are not so valuable as the data obtained in the flow tests. The results obtained by this test average from 2 to 4 degrees centigrade below those for the solidification point as obtained through cooling curves.

The determination of the temperatures at which compounds finally crystallize is easily carried out by making cooling curves as the materials pass from the plastic to the solid state. The temperature at which the crystallization takes place is considerably above the tempera-

PROPERTIES OF IMPRESSION COMPOUNDS

| Compound No. | Softening Point (Centigrade) | | Hardening Point from Cooling Curve (Centigrade) | Flow at (Per Cent) | | | | Working Range from Flow* Curve (Centigrade) | Tensile Strength (Lb. per Sq. In.) | Shrinkage from 40 to 25 C. Per Cent | Determined by Cooperate Committee | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A. S. T. M. Ring and Ball (Centigrade) | Durometer | | 35 C. (95 F.) | 40 C. (104 F.) | 45 C. (113 F.) | 50 C. (122 F.) | | | | Working Range† (Centigrade) | Classification of Compounds† |
| 1 | 70.5 | 38 | 40.0 | 5.0 | 53.0 | 82.0 | 89.0 | 50–55 | 450 | 0.35 | 55–60 | Good all-round |
| 2 | 65.5 | 37 | 41.0 | ..... | ..... | ..... | ..... | ..... | 460 | 0.60 | 45–55 | Good low heat |
| 3 | 74.0 | .. | 41.5 | ..... | ..... | ..... | ..... | ..... | 530 | 0.80 | 65–70 | Good high heat |
| 4 | 60.0 | 37 | 43.5 | 1.0 | 30.0 | 81.0 | 92.0 | 45–50 | 480 | 0.60 | 50–55 | Good low heat |
| 5 | 63.0 | 36 | 41.5 | 2.0 | 46.0 | 86.0 | 91.0 | 45–50 | 480 | 0.45 | 45–55 | Doubtful value |
| 6 | 65.0 | 40 | 43.0 | 0.5 | 3.0 | 45.0 | 88.0 | 50–55 | 490 | 0.30 | 55–60 | Good high heat |
| 7 | 74.0 | 35 | 40.5 | ..... | ..... | ..... | ..... | ..... | 370 | 0.30 | 50–55 | Doubtful value |
| 8 | 95.5 | 38 | 36.5 | ..... | ..... | ..... | ..... | ..... | 380 | 0.30 | 65–75 | Unsatisfactory |
| 9 | 74.5 | 39 | 43.0 | 0.5 | 3.0 | 45.0 | 87.0 | 50–55 | 420 | 0.45 | 50–60 | Doubtful value |
| 10 | 81.5 | .. | 39.5 | ..... | ..... | ..... | ..... | ..... | 350 | 0.35 | 65–70 | Unsatisfactory |
| 11 | 88.0 | .. | 40.0 | ..... | ..... | ..... | ..... | ..... | 380 | 0.45 | 65–70 | Unsatisfactory |
| 12 | 74.0 | 37 | 45.5 | ..... | ..... | ..... | ..... | ..... | 520 | 0.45 | 50–55 | Fair low heat |
| 13 | 62.0 | 39 | 42.5 | ..... | ..... | ..... | ..... | ..... | 420 | 0.40 | 50–55 | Doubtful value |
| 14 | 64.0 | 37 | 43.0 | ..... | ..... | ..... | ..... | ..... | 390 | 0.40 | 50–55 | Fair low heat |
| 15 | 65.0 | 37 | 42.0 | ..... | ..... | ..... | ..... | ..... | 430 | 0.30 | 55–60 | Unsatisfactory |
| 16 | 62.5 | 39 | 43.0 | ..... | ..... | ..... | ..... | ..... | 410 | 0.50 | 50–55 | Unsatisfactory |
| 17 | 87.0 | 36 | 39.5 | ..... | ..... | ..... | ..... | ..... | 350 | 0.25 | 50–55 | Fair low heat |
| 18 | 71.0 | 40 | 42.5 | 2.0 | 24.0 | 73.0 | 91.0 | 50–55 | 420 | 0.55 | 50–55 | Good low heat |

*Flow 90 per cent or over.
†By observation in practical use.

ture at which the materials lose all plasticity and so perhaps should not be called a hardening point. The determination is of value in making certain that the materials do not crystallize at temperatures abnormally high or low. The normal range for the better compounds is from 40 to 43 C. (104 to 109 F.). It may be possible for manufacturers to produce a compound which crystallizes at the lower temperatures and which will have sufficient rigidity for use at mouth temperatures, but no material having these characteristics was found among those tested.

The flow tests give data which are valuable in determining the rigidity of compounds at mouth temperature and their ability to flow under pressure at higher temperatures. Compounds should not flow appreciably at mouth temperature and should certainly reach their working range below 55 C. (131 F.). The term "working range" as applied to compound differs from the use of the same term as applied to inlay wax. The working range of compounds as indicated is not the temperature range in which it is applied to the tissues, but is the temperature range at which it softens sufficiently to be placed in the tray prior to starting the impression-taking process.

A compound must exhibit a flow of 80 per cent, and preferably 90 per cent, before it can be considered properly softened for use. Its flow is much lower than this when it is placed in contact with the tissues, but these values give sufficient plasticity for the preliminary forming operations.

The materials tested all had sufficient strength for practical use. This property is dependent on the types and amounts of gum present in the compound. The effect of variations in temperature is large, and it seems questionable that a strength requirement should be set up for compounds.

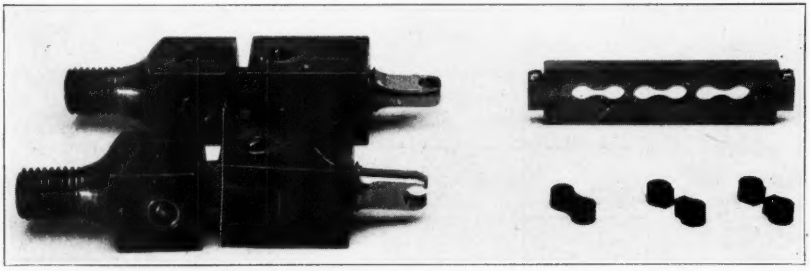

Fig. 5.—Molds, grips and samples used in the determination of the tensile strength of impression compounds.

The normal use of compounds gives impressions of considerable accuracy at mouth temperature. These impressions are later used at room temperature, and, in passing from the one temperature to the other, some shrinkage takes place. This shrinkage should be kept at a minimum, since it increases the difficulty of compensating for the shrinkage of gold when castings are made. The average shrinkage from 40 to 25 C. (104 to 77 F.) was found to be close to 0.45 per cent. The data given were obtained from compound samples produced as the den-

tist might produce an impression. The materials undoubtedly had considerable air incorporated in them, and, as a result, the values obtained are probably greater than would be obtained had the entrapped air been carefully removed.

The final columns in the tabulated data give the working ranges and classifications of compounds as determined by the committee from the dental profession which cooperated in this study. These data are based upon the practical working characteristics of the compounds, which included their behavior when flamed and trimmed.

These data, together with the many other obtained, indicate that there are a considerable number of impression compounds offered for sale to the dental profession which are questionable for dental use. This situation was called to the attention of the manufacturers of impres-

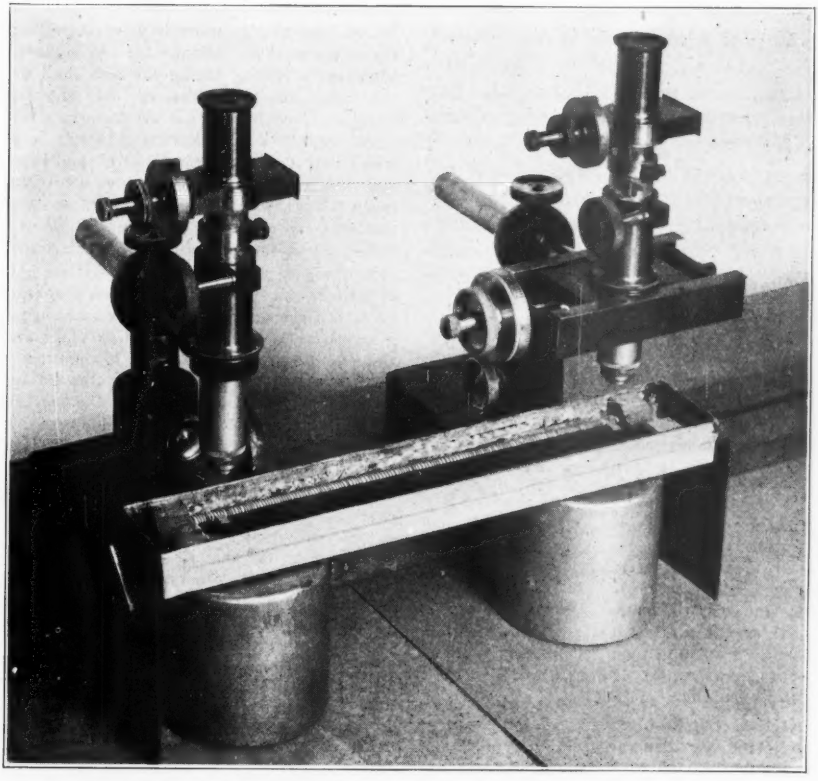

Fig. 6.—Preliminary form of set-up used in the determination of thermal changes of impression compounds.

sion compound on two occasions. Six firms (less than half of this group) replied to the correspondence.

The preparation of a specification under these conditions was difficult, but from the data presented and from general ideas as to what an impression compound should be in order to record satisfactorily the dimensions which are necessary to the success of a technic using this material, the following specification is submitted. It is given in the hope that it will bring forth the thought of others, who will discuss the specification with us. Further, it is hoped that the data presented will suggest to others the need of testing impression compound both by the methods here used and by others that might be developed. A satisfactory specification can be formulated more quickly from concerted thought and action on the part of all of those interested in this type of material.

AMERICAN DENTAL ASSOCIATION SPECIFICATION NO. 3: TENTATIVE SPECIFICATION FOR DENTAL IMPRESSION COMPOUNDS

(Approved July 24, 1930)

I. Material: The compound shall be free from foreign materials and uniformly fine grained.

II. General Requirements: Impression compounds shall have the following features known as satisfactory working properties: 1. A smooth glossy surface after flaming. 2. Ability to trim, at room temperature, without appreciable flaking. 3. Firm, smooth margins after trimming.

III. Detail Requirements: 1. The hardening point as evidenced by the principal arrest point in the cooling curve shall be not less than 40 C. nor more than 43 C. (104 to 109 F.). 2. *(a)* A sample 10 mm. in diameter and 6 mm. long shall not decrease in length more than 2 per cent when subjected to a constant load of 2,000 gm. for ten minutes at 35 C. *(b)* The softening point, as evidenced by a flow of 10 per cent or more when tested as above, shall not fall below 37 C. 3. The working range as evidenced by a flow of 85 per cent when tested as in III-2 shall be between 45 and 55 C. 4. The shrinkage of the material from 40 to 25 C. (104 to 77 F.) shall not exceed 0.5 per cent.

IV. Methods of Test: 1. The cooling curve shall be obtained by methods and equipment which insure an accuracy of $\pm 0.5$ C. in the location of the principal arrest point in the curve. 2. Flow tests shall be made on samples 10 mm. in diameter and 6 mm. long under loads of 2,000 gm. The sample shall have been maintained at the testing temperature for at least twenty minutes prior to testing and the test shall continue for ten minutes. Changes in length during the test shall be calculated as percentage of the original length. 3. The shrinkage of the material shall be determined by first heating a sample in a water bath to slightly above 40 C. and then observing the dimensional changes occurring as the temperature falls. The equipment used shall be sufficiently exact to insure an accuracy of $\pm 0.05$ per cent in the data obtained.

V. Packing: 1. The minimum net weight of the contents shall be indicated on all packages. 2. Each package shall be marked with a serial number or a combination of letters and numbers which shall refer to the manufacturer's records for the particular lot or batch of compound. 3. The date of manufacture (year and month) shall be indicated on the package as a separate item or as a part of the serial number.

VI. Notes: 1. Manufacturers may indicate that their materials comply with this specification by *(a)* a statement on the package guaranteeing the material contained therein to meet the requirements of this specification, or *(b)* a statement as to the physical properties of the compound. 2. The American Dental Association will not assume responsibility for, or guarantee compliance of, materials so labeled by manufacturers, but will, in event of a dispute between a member of the Association and a manufacturer, act in an advisory capacity and will designate laboratories having equipment for testing dental impression compounds where necessary tests may be made.

Preliminary copies of this specification were distributed to the manufacturers of impression compounds, and they have been given an opportunity to certify their willingness to produce materials meeting the requirements of the specification.

Some time is necessarily required to make minor changes in packages and labels, and the manufacturers were asked to indicate the latest date on which their product would meet all of the requirements.

DISCUSSION[4]

*R. E. Blackwell, Chicago, Ill.:* The information in the paper which we have just heard is enlightening to many of us who have worked for years more or less blindly on the casting problem. As soon as it is feasible to make explicit statements in publishing data on marketed investments, particularly the data on expansion curves, guesswork in casting should become a thing of the past. We know that the thermal expansion of investments varies somewhat according to the powder and water ratio. This makes necessary the use of scales and measuring glasses to insure the right balance of the investments. Also the spatulation, which influences the setting time, the uniformity and smoothness of the mix should be uniform in the time and amount. If ill-fitting inlays are to be replaced with castings of dimensional accuracy, much care and fine work will have to take the place of haphazard methods. We have been given a hint in this paper that the ultimate in casting to dimension may be found in investment expansion alone. Let us hope that this investment expansion technic can be worked out, as it should make for simplicity and do away with "clock watching" and other tedious work. Moreover, if this is to be done the profession will have immediate need of an oven, which meets these requirements and which is inexpensive to buy and to operate. Many of us, when working with our favorite investment from year to year, have observed that it was not always uniform in its behavior. I used one investment for several years, employing the same definite technic in each case. The results were satisfactory as far as the appearance of the castings was concerned. The margins were sharp and the castings smooth. Quite suddenly all this changed: the castings were rough and the margins without termination. Experimental case after case was carried through to check up on the technic and to determine where the fault lay. The trouble proved to be in the investment. A friend to whom I related this experience said that he bought his investment material by the barrel in order to be sure of uniform behavior over a prolonged period. Mention has been made today of a group of men who are studying the application of laboratory data to the development of inlay technic. I think I may be permitted to say that we were very much handicapped in our work this spring by lack of uniformity in a certain investment. This material was bought in the open market and tested for physical qualities in the Bureau of Standards laboratories. Mixed in a definite proportion of powder and water, it had an initial set of forty minutes. This was one reason that it was selected for our work. The material was then purchased at dental depots in several parts of the country and was distributed to the members of the committee. It was soon discovered that the material was not uniform in its setting time. Variations from fifteen to forty minutes were reported by members of the committee from different cities. As we were experimenting with wax expansion technic at the time, those members of the committee having a quick setting material were unable to do the work satisfactorily. It may not be practical to add to the American Dental Association Bureau of Standards Specifications for a casting investment the quality of uniformity, but if the dental profession is alive to the situation as it exists, pressure can be brought to bear on the manufacturers which will compel them to give us uniform products.

DISCUSSION

*L. G. Neff, Alliance, Nebr.:* Dr. Taylor mentioned the names of two compounds. What were they?

*Dr. Taylor:* I should like to explain the situation. We have been running the plasticity curves on the compounds in the last few weeks, and we have the six curves which are complete at present. We have twelve more which we hope to finish in the next month, and to have incorporated in the paper at the time it is published. While I can give you the names of three of the compounds at this time, I do not think it would be fair to the other compounds, so these names have been purposely omitted until we can give you the whole list. We have not been able to give you many details in these presentations. We have tried

4. This discussion covers also the paper on dental inlay casting investments published in the December issue.

to cover the materials accessory to the casting process and to get some basic ideas as to what we should expect from them. We hope that we will get the cooperation of the manufacturers in making changes and we feel that in many cases we now have it. We have been told by representatives of manufacturers that they cannot change their product at the present time without receiving a good deal of complaint on account of the change. They feel that if we have a standard, they will be able to make the changes to meet that standard with less trouble, and will do it very willingly. We know manufacturers of investments who have told us they could make the material stronger, harder and with greater thermal expansion, and they have been awaiting an opportunity to do this without getting too much pressure brought to bear on them by customers. We know of many cases in which the manufacturers know that theirs are not the best materials for the purpose, but they feel that they cannot make the change because competition has been keen, and that, in making changes, it would almost be necessary for them to educate their customers individually. They do much of that now when they come into your offices and demonstrate various materials. They would rather defer changes until they have had a little assistance in bringing the change about. I think you will find that the people making investments, waxes, and compounds will do as many have done with the amalgams. The original number of good amalgams was small, but we have every reason to believe that the number of good amalgams on the market has increased 100 per cent in the last year. We do not believe that much is represented in total sales, but in number of brands. We have some of the poor ones yet, but find that some are dropping out entirely. If this situation can be carried over into other fields, the dental profession will benefit greatly.

# EXAMINATION AND DIAGNOSIS BY THE DENTIST*

By ARTHUR D. BLACK, A.M., M.D., D.D.S., Sc.D., Chicago, Ill.

IT is the intention in this paper to discuss briefly a number of matters in connection with the visit of a patient for examination. The purpose of such an examination is to learn what should be done to maintain the mouth in the best of health by either preventive or reparative service. It should be kept in mind that the most painstaking examination is of little value to either patient or dentist unless it is so conducted that the patient will accept the dentist's judgment and arrange to have the service performed. It is important, therefore, that the dentist pay attention to all of those things which tend to establish the highest degree of confidence in the mind of the patient.

Consideration of all related matters would possibly carry us too far into the field of practice management. It would include the important questions of the first telephone call or visit by the patient to make an appointment for the examination, and his impression of the reception room, the assistant, the dentist himself, the equipment of the operating room and the cleanliness and general atmosphere of the place.

Last summer, while in Ireland, I awakened one morning to find that a lower molar tooth was slightly tender to heavy pressure and, as we were sailing for home the next day, I thought I had better see a dentist and have a roentgenogram made.

*Read before the Section on Operative Dentistry at the Midwinter Clinic of the Chicago Dental Society, Jan. 15, 1930.

I had heard many stories of the crudeness of dentistry in Ireland, and it was with some trepidation that I made the call, after rather careful inquiries. I would not have been surprised to find an equipment of forty years ago, but, to my great delight, I was ushered into a reception room and operating room beautifully furnished and as well equipped as one might find among the best offices in this country. It was not expensive equipment, but it was adequate, clean and evidently in good order. The office bespoke the dentist, and I found him to be a very up-to-date man in every respect.

What of yourself? Look in a full length mirror and see what impression you make on yourself. If you were the patient, what would you criticize in yourself, the dentist, as to your personal appearance; shoes shined; trousers pressed; collar, face and hands, fingernails and all, clean?

How about your manner and your conversation as impressing the patient with the thought that you are going to make a thorough examination? You ask the patient certain pertinent questions as to his dental history and his present complaint, if any, and you should be studying the patient, while he is doubtless "sizing you up." We will pass this phase by suggesting that you put yourself in the patient's place and consider the general impression that the dentist would make on you.

The instruments necessary for an examination should be carefully selected and kept in good order. Those to be used for what might be termed a routine examination should be kept together. They should be laid out on the tray after the patient is seated in the operating chair. One should have at least two complete sets, so that a clean set is always ready. This set should include the following: a mouth mirror; three explorers, one almost straight, and a pair of small right and left curved instruments that are best adapted for the examination of proximal surfaces close to the contacts; cotton and cotton pliers; silk floss; an air syringe; a water syringe and warm water. A mechanical separator is often necessary to aid in finding small proximal areas of decay. For adults, a pair of peridental explorers, for determining the location and depth of pockets, should be added. For testing the vitality of pulps, small pieces of baseplate guttapercha, also an electric pulp-testor, should be at hand. For the exploration of sinuses to determine the condition of bone, a Gilmer sharp steel probe and a blunt end silver probe should be available. Reference will be made later to the use of the roentgen rays.

In making a routine examination, the dentist should have in mind the following conditions: 1. The occlusion. 2. The general condition of the teeth. 3. The general appearance of the entire mucous membrane of the mouth. 4. The condition of the mouth as to cleanliness. 5. Inflammation caused by deposits of salivary calculus. 6. Gingivitis caused by deposits of serumal calculus. 7. Injuries to the gingivae caused by open contacts or bad contacts; by imperfect margins of fillings or crowns, etc. 8. Injuries caused by misuse of toothpicks, rubber bands, brushes, etc. 9. Detachment of the peridental membrane. 10. Chronic alveolar abscess. 11. Hyperemic, inflamed or dead pulps. 12. Caries.

In the actual examination, a definite routine should be followed which will include all of the foregoing, although it is not necessary to make a separate survey of the mouth for each item mentioned. It is not important what plan is followed, but it should be one which

covers the field. It is of the utmost importance that each dentist train himself in the habit of following a regular plan in order that nothing may be overlooked. Each condition should be recorded as the examination proceeds. A detailed statement of a simple plan of making this record will be given.

After the general survey of the mouth, what might be termed the technical examination may be conveniently divided into three parts: (1) for cavities of decay; (2) for inflammations of the investing tissues; (3) for pulp conditions and the changes which follow pulp death.

It is hardly necessary to state that a patient is very likely to recognize the difference between a thorough and a casual examination. The examination should be the most thoroughgoing that the dentist can make, and every finding should be recorded, so that the task is finished for the series of operations to be performed.

After the examination is completed, what service is necessary will be determined. It will be in order to discuss this with the patient to secure his approval. The amount of the fee, and the arrangement for its payment, should oftentimes be agreed on. The thorough examination is now helpful in two ways: (1) a certain confidence should have been established in the mind of the patient, so that he is more likely to accept our decision, as to both the service and the fee; (2) we are in position to make nearly an exact estimate, because we really know what is required. If the patient does not ask the cost, it is in order for the dentist to ask him if he would like to know the approximate cost. This is a good introduction to the plan of payment.

The arrangement for payment should usually be varied according to the patient and the circumstances which brought him to us. If he was sent in by another patient, we may telephone that patient to make inquiries, or we may be satisfied to extend credit because he was sent in by a patient who is of good reputation. As a general rule, it is best to have an understanding relative to the total amount and the manner of payment. A certain amount may be required as a cash payment, and the balance at stated intervals as the work proceeds. If the amount is large, some dentists ask that a contract be signed. In some cases, the only satisfactory plan is to require that each operation be paid for in cash as the work proceeds.

There will be patients with whom it does not seem wise to force the matter of a plan of payment at the time of the examination, particularly when some member of the family other than the father is the patient. In all such cases, if there is doubt about the likelihood of payment, little should be done during the current month and a bill should be sent at the end of the month. Payment of the bill, or a mutually satisfactory arrangement, should be made before the work proceeds.

The reverse side of the examination card is used for the estimate of the cost. One should list the operations with approximate fees, and then give an estimate for these operations. It is well to state that, as the work proceeds, something additional may be found necessary, which will of course increase the total fee. If a plan of payment is agreed on, that should also be noted.

Whenever this patient has an appointment, the examination card is laid on a side table or on the operating cabinet, and as each operation is performed and recorded, it is checked on the examination card. In entering the fee, the estimate on the reverse side is conveniently at hand. Each time the patient returns, this card shows exactly what has been done and the operations yet to be performed. As a

rule, it may be decided before the patient enters the operating room what is to be done at that sitting and there need be no loss of time in getting at it.

When the series of operations is completed, the patient should be told when his teeth should again be examined. This is the time to suggest the importance of an arrangement for periodic examinations, which may be done very simply. The dentist should emphasize his willingness to make a memorandum to send the patient an appointment in six months, or whenever he should come in, provided the patient desires him to do so. Most patients will appreciate this bit of special attention.

Again the examination card is used. A drawer of proper size should have twelve guide cards, one for each month in the year, the examination card for each patient to whom an examination appointment is to be sent at some future time being placed behind the guide card for the proper month. As the plan of periodic appointments is gradually accepted by a considerable number of patients, the dentist will have these notification cards (the examination cards) filed in groups behind each guide card for six months in advance.

This arrangement gives an excellent opportunity to adjust one's practice within each month. When the first of the month arrives, all the patients who are listed for examination may be sent appointments at once, or the notices may be scattered throughout the month, this depending on the amount of work one has on hand at the beginning of the month.

Still another use is made of the examination card. When the patient returns for the next examination, this card (made out six months previously) is again on the side table. The first step in the new examination is to check over the operations previously performed and to note conditions. This is a most important item in good practice management. It confirms the patient's first impression of our thoroughness. It gives us an opportunity to check up on ourselves and find out whether we are giving the best service of which we are capable.

Incidentally, the plan of carrying the examination card over from one examination to the next affords an opportunity also to carry over any desired memoranda. For example, a gingival third area that has a white spot, but no cavity, in an area where the patient is not brushing properly, might be marked to "watch," and the patient might also be told to be more careful about brushing it. When the patient returns in six months, we are reminded to look at this area and comment regarding it. Possibly, the question of making a bridge for a certain space might have been discussed, and the patient told what the fee would be, but the service may have been postponed. If a memorandum of the type of bridge and the fee is made on the card, it will be at hand six months later, when the question of the bridge is reopened.

A new examination card is made out each time that the patient returns for reexamination.

The dental profession is far ahead of the medical profession in promoting the general plan of periodic examinations, and is therefore giving much better service to the group in need of these examinations. However, dentists have been slow to grasp the opportunity to serve children on a very satisfactory fee basis by applying the periodic examination plan to them. There is no greater asset in practice building than the child, if a proper working plan is developed. There are two important basic features: (1) the child should have its first appointment at

about its third birthday; (2) it should have subsequent appointments every three months for several years and then at slightly greater intervals.

This opens up a field of practice that most dentists know nothing about. It is so different from their conception of children's dentistry that there is no comparison.

The child is brought to the dentist at 3 years. He climbs up in the chair, and the dentist examines his teeth. There is nothing to be done. The teeth are polished a little with a brush in the engine, although they do not need it. The entire appointment requires from five to ten minutes. The dentist has become acquainted with a new "customer," who may, if properly "managed," be a good customer during the remainder of the dentist's life. The child has met the dentist and has enjoyed it. He will ask his mother, the next day, when he may come again.

In three months, we send an appointment card, and he comes in again. Possibly there is nothing to be done, and the performance is repeated. We are at least better acquainted. Possibly at this or at a subsequent appointment, we find one or two pit cavities. They are necessarily small, because so little time has elapsed, and they can be prepared with the engine with so little pain that the child does not mind. Some black copper cement, and the child is gone in ten minutes. And so it goes: the establishment of pleasant relations, easy work for the dentist, not bad for the child, and the time so brief that the father does not object to paying a fee at the same rate per hour that we charge him. Each such child becomes a good "rooter" for his dentist, and almost before we realize it, he is a boy in high school, then a college boy and then a business man. There is no fear that he will go to anyone else as long as we do our part.

Compare this little recital with that of the child who is brought in with a tooth that has been aching for several days and nights. The child has lost sleep, and is very much unstrung and in no condition to be punished more. Yet this child must, in all probability, be hurt by the dentist in order that the pain may be relieved. Possibly some one has told him that we will not hurt him. He goes away with both fear and hatred for the dentist. He has six or eight more cavities, all requiring that he be hurt more in preparing and filling them. What would we give for this child as a "customer"? If we are lucky, he may forget in a few years, but he will never like to come to see us.

No doubt, many dentists have not taken sufficient time for examinations to make them thoroughly, principally for the reason that they are unable to collect a proper fee for the examination. There is no argument of the point that a fee should be charged; the fact is that in most communities people object to paying, because they have not been taught to realize its importance. It is really the fault of the dental profession, and we should not blame the patient. The majority of the people of any community may be educated to pay this fee if the dentists will cooperate in the endeavor. If a minimum fee is agreed on, yet it be a low fee at first, and if each dentist will say to his patient, before making the examination, that careful examinations are necessary on account of the importance of the teeth in relation to the general health, and that a fee of so many dollars is charged for it, most of the better patients will pay. Those who refuse will go to see another dentist and will be again told that they must pay. They may try still another, and then give up. There will be a little

general shifting of the shoppers, but each man will probably get his share, and within a year the community will be educated.

The dentists of a community can accomplish anything that is fair and for the best interests of their patients if they will have sufficient confidence in one another in all such matters.

In the meantime, the best way that suggests itself is to make it a rule to give an appointment for a combined examination and prophylaxis, charging a single, but sufficient, fee for both.

There can be no question that it will be a matter of real economy for patients to pay a good fee for a thorough examination, because more cavities will be found while they are small, the cost of the service will be reduced and they will less often be compelled to have a tooth extracted.

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# CHARLES ALLEN'S "THE OPERATOR FOR THE TEETH," YORK, 1685: THE HISTORY OF THE FIRST ENGLISH DENTAL PUBLICATION, WITH CORRECTIONS

By BERNHARD WOLF WEINBERGER, D.D.S., New York City

IT is the desire to come into personal possession of intellectual heritage of a profession that brings together groups of men, learned, less learned and unlearned, who constitute the personnel of dentistry. The heritage is transmitted to us by the teachings of the learned and by the treasures of art and literature preserved in museums and libraries. We enter into possession of it by receiving these teachings and by coming under the influence of the ideas handed down by whatever means from those who have gone before. To what we thus receive, we add by our own experiences and observations. A library exists for the purpose of preserving, disseminating and increasing the knowledge of a profession. We are dependent on what we receive from others older; our own life, unaided by others, would discover but little.

All courses of study have a historical background. Things were not always as they are, and what they now are is the result of thoughts and acts of many generations of thinkers and doers. The profession is familiar with the history of dentistry and recognizes that dentistry is simply that which is accepted today as true; for it may, tomorrow, if more knowledge is forthcoming, be greatly modified, as has repeatedly happened.

During the past ten years, I have repeatedly stated that the true dental history is just now beginning to be written. By this, I do not mean the important changes that are now taking place, but the evaluation of the past and just what has been written.

There has hardly been a year during the past decade when some new "old" work or fact, not heretofore known, has come to light that upsets our previous knowledge, and thus gives us another new approach to some phase of dental history. The most interesting one, and

perhaps the most important to the English reader, is "The Operator for the Teeth," though the same thing can be said of the group of the "Zene Artznei's."

There is no dental history that contains the story of dentistry as we know it today. They were correct at the time they were written, but the "missing links" in the literature are gradually being discovered, so that we might correct those errors that have unfortunately crept in. There are still many that we cannot link with our present knowledge and material at hand.

In the June, 1924, issue of THE JOURNAL I contributed an article entitled "The First English Dental Publication,"[1] stating:

> It is my privilege to present to the dental profession the contents of the first known dental work in the English language, published by Charles Allen in 1687. I say present to the dental profession, for, so far as it is known, this rare work has until now escaped the eyes of all dental historians. The only reason known for this must be that heretofore no copy was to be found in any of the dental or medical libraries, and it was merely by chance that I was able to purchase this specimen.

My copy was obtained in March, 1923, from Quartich of London, who purchased it as part of the library of the late Earl Pembroke, in March, 1920.

During the summer of 1923, while in London, I inquired at the British Museum for a copy of Allen. As it was not cataloged, the librarian had no knowledge of it, and he doubted that they had such a work. In the fall, I received word from them that they finally did locate this work, "the press-mark 782.1.5 (1), British Museum, which judging from the stamp on one of the leaves, must have been in the possession of that Library considerably over one hundred years. However, it had apparently not been entered under the name of Charles Allen in the British Museum Catalogue, until comparatively recently . . . it was apparently first entered in one of the accession catalogues." This is the copy that Mrs. Lindsay used as a basis for Dental Reprint No. 1, and the only other one known at that time.

1. Weinberger, B. W.: J.A.D.A., 11:506 (June) 1924.

### HISTORY OF THE BOOK

In the foregoing article, I stated:

> It was a surprising and indeed a curious fact that none of the forty dental histories so far published, including Guerini, mentioned this work. The same might also be said of the dental bibliographies. Though Carabelli, in his excellent historical survey of dental history (1844), fails to say anything of this book, in his bibliography, page 159, he records it as follows: Curious observations on that part of chirurgery relating to the teeth, 4° London. The same was true of Linderer, for in his history (1851) he also neglects to mention this work but records it on page 442, as did Carabelli. Besides Linderer, the only other bibliographies that contain this item are Coles, Crowley, Sternfeld, Port and Greve. Coles in 1883 neglects to mention the book, but on page 6 of his list of works on dentistry, he heads the English section: No Name—Curious Observations on that part of Chirurgery relating to the Teeth, London. Crowley, on page 10, in 1885 strangely gives Allen credit for the work: No. 1509, Operator for the Teeth, Dublyn, 1687; and the second item in the English section, No. 1510, Curious observations on that part of chirurgery relating to the teeth, London, 1687, he credits, on page 180, to an anonymous author. Sternfeld, in 1891, happened to give the author's name correctly, but the title of the two works incorrectly. He states that he obtained this information from Crowley, but failed to note that No. 1510 was by an anonymous author, as all other bibliographers have so far done. In fact, it appears that all who so far have compiled their bibliographies copied them from Carabelli and later Crowley. The errors in the name, title or place of publication have never been corrected.

p.24

THE

# OPERATOR

For the

# TEETH,

Shewing how to preſerve the *TEETH* and *GUMS* from all the Accidents they are ſubject to.

*By* CHARLES ALLEN *Profeſſor of the ſame.*

Entered according to Order.

*YORK*,
Printed by *John White* for the *Author*, and are to be ſold by himſelf at his own Lodging, at Mr. *Galloway's* Apothecary in *Stonegate*, Anno Dom. 1685.

Fig. 1.—Title page of the heretofore unknown and unrecorded edition of the first English book on Dentistry; published in York, England, 1685. (Courtesy of its owner, Theodor Blum.)

On page 522, I also stated, "We know very little about these, it is probable they may be different imprints of the same work," and then gave the following conclusions:

Had a copy of this treatise ever been in the hands of, or seen by, a dental practitioner, it seems hardly probable that it would have taken 236 years to learn the name of the author, the correct title, the position, so far as priority in sequence is concerned, and the place of publication of the first dental work in English.

It is surprising and indeed a curious fact that it has taken all these years definitely to establish who wrote and which was the first English dental work, as well as to correct the errors found in all of the dental bibliographies so far published.

For some unknown reason, none of the dental histories so far written mentions anything regarding Allen or his two dissertations. This is rather astonishing when all of them considered the first works published in every country except England. The only explanation that can be offered is that the copy recently acquired happens to be the only one known and must have been hidden all these years in some obscure corner in the library of some unknown collector.

All dental and medical bibliographies heretofore have erred in placing the second paper of Allen's "Operator for the teeth" as the first, and "Curious Observations, etc.," by an anonymous author, as the second.

We now have definite proof that the first English dental publication was written by Charles Allen in Dublin, printed in the year 1686 and published and sold in London in 1687.

His "Advertisement to the Readers" confirms the "Epistle Dedicatory" as to which was the first work he wrote, as well as that he was "the first, as far as I know (and by this he undoubtedly refers to English publications) that ever wrote anything of this nature.

From his introduction in the "Proem," we are led to presume that he also was the first English dental practitioner, at least so far as is known, for he states, "Of what importance it is to all men to be informed of those benefits which by MY ART they may enjoy," also, in Sect. 1, "And therefore being about to treat of My Art."

As today our keynote is prevention, so we learn from Allen that such was the case nearly two and a half centuries ago.

Of what utility this undertaking of mine may be to everybody, will appear by the sequel of this discourse, whereof the scope is to prevent the loss of TEETH—In a word that—want of them, is as great a deformity, and of as much prejudice to one, as anything whatsoever can be.

In December, 1924, the British Dental Association republished, as Dental Reprint No. 1, the copy in the British Museum. This was written by Mrs. Lillian Lindsay. In her introduction, she gave a short history of the book as she was able to piece it together, the various copies then known, and other information that we lacked, but failed to mention the article in the June number of THE JOURNAL for that year.

In part it was as follows:

This small quarto which has attracted the attention of dental librarians in America and England during the last year has been known only by a title, sometimes beginning without an author's name attached, in dental bibliographies from the beginning of the nineteenth century, and has been mentioned only by one or two writers on dental literature. The reason for its preservation does not lie in its value as a dental work, nor in the fact that it seems to be the first book on the subject written in the English language, but rather because it is one of the rare examples of printing in Dublin in the seventeenth century. That century was probably one of the most troublous and disastrous that even distressed people of Ireland have experienced. Rebellion, suppression, war and persecution were their lot without intermission, persecution of both Protestant and Catholic, and civil as well as religious. Writers of all kinds were afraid to have their works published, and those who dared do so could hardly get printers brave enough to carry out the work; therefore, many Irish works were published abroad, or, when published at home, bore in

THE

# OPERATOR

For The

# TEETH:

SHEWING

How to Preſerve the Teeth and Gums from all the Accidents they are ſubject to: With particular Directions for Childrens Teeth.

As alſo the Deſcription and Uſe of the *POLICAN*, Never Publiſhed before.

By *CHARLES ALLEN*, Profeſſor of the ſame.

To which is Annexed

A Phyſical Diſcourſe, wherein the reaſons of the Beating of the *Pulſe*, or *Pulſation* of the *Arteries*, together with thoſe of the circulation of the *Blood*, are mechanically Explained; which was never done before.

By an Unknown Hand.

*DUBLIN*, Printed by *Andrew Crook* and *Samuel Helſham* for the Author, and are to be Sold by *Robert Thornton* Bookſeller, at the *Leather-Bottel* in *Skinner-Row*, and by the Author at his own Lodging at Mr. *Baniſter*'s at the *Smiths-Arms* in *Eſſex-ſtreet*.

Fig. 2.—Title page of the second edition; Dublin, 1686. (Courtesy of the Librarian of Trinity College, Dublin.)

some cases the name of a foreign town—such as "printed in Roan" (Rouen). Only writings such as this of Charles Allen, which contained no controversial matter, could readily obtain a publisher.

The first copy of this book was entitled "The Operator for the Teeth," showing how to Preserve the Teeth and Gums from all Accidents as also the Description and Use of the Polican, to which is annexed A Physical Discourse, wherein the Reasons of the beating of the Pulse, or Pulsation of the Arteries, together with those of the Circulation of the Blood are explained, the Opinion of several Ancient and Modern Physicians and Phylosophers, as Gallen, Gassendus, Cartesius, Lower, Willis, &c. Printed in 1686 by Andrew Crook and Samuel Helsham for Robert Thornton, bookseller, at the Leather Bottel, Skinner's Row, Dublin." There are 58 pages and I leaf. At the bottom of page 44 appears "Printed in Dublin in the year 1686." The size is stated as 4to, 7⅜ by 5⅛. The only copy known to exist of this edition is in the library of Trinity College, Dublin.

In the next year, 1687, another edition or reprint appeared, entitled "Curious observations in that difficult part of Chirurgery relating to the Teeth, shewing How to Preserve the Teeth and Gums from all Accidents they are subject to." The size of this is somewhat smaller than the first, being 4to, 7½ by 5¼, I leaf plus 58 pages plus I leaf, the last leaf being a list of contents. There are seven copies of this edition known to exist, namely, Trinity College, Dublin; Bodleian Library, Oxford; British Museum; King's Inns, Dublin (this one bears the Imprimatur of the Archbishop of Dublin on the verso of the title page); E. R. McC. Dix, Dublin; Marsh's, Dublin, and the Royal Irish Academy—to these we must now add that copy in the possession of Dr. Weinberger of New York.

For some unknown reason this imprint found its way to London and was advertised for sale in the Catalogue of Books, Printed and Published at London in Michaelmas term, 1686, that is December 13. It occurs under the heading Physick, and after the title "Curious Observations," &c., is printed "Printed at Dublin and are to be sold in London by William Whitwood in Duck Lane." 1687.

Charles Allen addresses his book to the Physicians, Surgeons and Apothecaries of Dublin; it bears the Imprimatur (i. e., the permission to print) of the Archbishop of Dublin, Archbishop Francis Marsh. The author styles himself "Professor of the teeth," and all that the present writer can discover about him is taken from the book itself. We know that he had worked for another operator whose name is not revealed,[1] but who is twice mentioned as "my master," the first time in terms of disapprobation for giving a name to a dentifrice "improper as well he knows," the second time in support of the operation of transplantation, describing a case in which his master operated with success.

Allen claims to have invented several instruments and offers to describe them in the next impression of his work. He gives a description of the Polican, but lightly passes over the method of making it and the material of which it is made . . ."

In addition to those Mrs. Lindsay recorded as known, the following copies are now in the libraries of the British Dental Association, 1687; Theodor Blum, N.Y., 1685, 1687; K. Klein, Amsterdam, 1686, and the York Minister Library, York, 1685.

Why this book has become so valuable I am unable to state, but the price has gradually increased from $30 for the then only known copy to now over $1,000.

### THE DIFFERENCE BETWEEN THE 1686 AND 1687 EDITIONS

The only difference between the two editions is in size and the title page. The contents are the same page for page.

There is a slight variation in the size given in the 1687 editions, that of Dr. Blum's being 8¼ by 6 inches or 21 by 15¼ cm. The British Museum's is 7½ by 5¼. My original copy was cut and cannot be used to check up this discrepancy.

1. Since this was written we have learned that his master's name was Bannister. This we understand is stated on the first leaf of the first edition, a copy of which is in the possession of Dr. T. P. C. Kirkpatrick, Dublin.

CURIOUS

# OBSERVATIONS

In that difficult part of

# CHIRURGERY,

Relating to the

# TEETH

SHEWING,

## How to Preſerve the Teeth and Gums from all Accidents they are ſubject to.

A S,

1. An Account of their Nature. 2. Their Alteration, with their proper Remedies. 3. Their Cauſe of Corruption and Putrefaction. 4. Directions for reſtoring or ſupplying the defect of them in old or young. 5. Conſiderations on the Tooth-Ache, Looſeneſs of the Teeth, the decay of the Gums, with their Remedies and Reſtoratives. 6. The uſe of the POLICAN or Inſtrument wherewith, they are drawn on all Occaſions. Laſtly, Teeth in Children, what they are in the Original, and how they come to Perfection, in what order produced, the means to haſten them, and render them eaſie in breeding.

To which is added,

A Phyſical Diſcourſe, wherein the Reaſons of the beating of the Pulſe, or Pulſation of the Arteries, together with thoſe of the Circulation of the Blood are explained, and the Opinions of ſeveral Ancient and Modern Phyſicians and Philoſophers, as *Gallen*, *Gaſſendus*, *Carteſius*, *Lower*, *Willis*, &c. Upon this Subject are examined.

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*DUBLYN*, Printed and are to be ſold in *London*, by *William Whitwood* in *Duck-Lane*, 1687.

Fig. 3.—Title page of the third (reprinted) edition; London, 1687.

The part relating to dentistry occupies but forty-four pages of the fifty-eight; the other fourteen pages relate to the "Physical Discourse, etc."

NEW EDITION, YORK 1685

What has heretofore been stated was our previous knowledge of Allen and his book. We cannot always jump at conclusions from merely one copy, the only one known at the time that I called attention to this work. We were justified in giving the reasons that we reached this opinion from the advertisement in the book, which was and is misleading. "Things are not always as they are," but if it creates an interest, time will correct these errors if given publication.

For additional history relating to this work, the scene again reverts to this country, and I again have the opportunity to bring before the dental profession more knowledge regarding Allen and his "Operator for the Teeth."

I was given a photostatic copy through the courtesy of Theodor Blum, who recently was fortunate enough to obtain another copy for his library, not only of the 1687 but now of an entirely unknown and unrecorded edition.

Illustrations 1, 2 and 3 readily show the difference in the title pages. The size of the 1685 copy is somewhat smaller than the others, being 4to, 7 by 5¼, or 17¾ by 13½ cm., with title page, one leaf, plus twenty-two pages.

The title page does not contain, "with particular directions for children's teeth," nor "as also the description and use of the Polican, never before published," as well as the annexed, "A physical discourse, etc." This edition was printed in York, England, "by *John White* for the *Author,* and are to be sold by himself at his own lodging, at Mr. *Galloway's* Apothecary in *Stonegate,* Anno Dom. 1685."

This was published by (permission) of "Imprimatur *Ro. Altham.* R^mo. P D. *Johan,* Archiepisc. *Ebor* à facris Domesticis."

It lacks the page "To the most Honourable and Truly Learned. The Physitians, Chirurgions, and Apothecaries, of the City of Dublin . . ."

Following the "Imprimatur" is page 1, containing the title, "The Operator for the Teeth" in large letters. Then the words, "The Proem," which is printed in italics in this edition, and, extending to the first third of page 2, is as follows:

*Knowing, that it is the duty of every man, and especially of such as live under civil Government, (where the general Interest alwayes includes the particular) to contribute as much as he can (in his own Station) to the publick Good: and also of what importance it is to all men to be informed of those benefits which by my Art they may enjoy; I am resolved to set down here, what I think most convenient for every one to understand concerning the preservation, and melioration of his own Teeth; a thing indeed of little esteem among most people, but in truth of inestimable value for its many and important consequences, However, in so doing I shall acquit myself of my duty towards God, and Man; and provided my endeavours prove but beneficial to others (as certainly they will, if put in practice) it is all I desire, caring very little what opinion the Criticks may have of me.*

*Of what utility this undertaking of mine may be to everybody, will appear by the sequel of this Discourse: whereof the scope is to prevent the loss of Teeth, the use of which is so necessary in the preparing of food, that the want of such a help (if not supplied by strong dissolvents) hinders a true concoction of the Aliments in the Stomach: whence do proceed indigestions, and abundance of crudities very noxious to the body of man: as being the feed of most of those innumerable diseases, and infirmities whereby life is not only made troublesome to us, but also considerably shorter than it would otherwise be: which is so consonant to truth, that vulgar observations it self has turned it into a common*

***Proverb:** For they use to say of one whose Teeth are naturally thin, that he is short liv'd, whereof the reason is that such persons do not chew their meat well: moreover the loss of Teeth renders the pronunciation both troublesome to ones self, and unintelligible to others: in a word the corruption and want of them is as great a deformity, and of as much prejudice to one, as anything whatsoever can be.*

Section I, "Of the Nature of the Teeth" occupies pages 2, 3, 4 and two-thirds of page 5; Section II, "Of the Alteration of the Teeth, with their Remedies," pages 5, 6, 7 and half of page 8; Section III, "Of the Corruption of the Teeth, with their Remedies" (whereto is annexed the description and use of the Polican" does not appear), second half of page 8 and 9; Section IV, "Of the Restauration of the Teeth," pages 10, 11 and three-quarters of page 12; Section V, "Of the Tooth-Ake, Looseness of the Teeth, and decay of the Gums, with their Remedies," last quarter of page 12, 13, 14, 15 and 16; Section VI, "Of Children's Teeth," pages 17, 18, 19, 20, 21 and a quarter of page 22. Section VII, "Of the Acceleration of the Teeth," does not appear in the York edition, nor the annexed material.

The book closes with the Advertisement to the Readers.

Gentlemen,

Although I have offered nothing in this Paper, but what is according to my own experience, and the best of my knowledge: yet I will not say but that I have been deficient in many things, and have committed a great many Errors in the management of my Subject; but if you consider that I am the first (as far as I know) that ever wrote anything of this nature; and withal, what is to be expected from one in my Circumstances: I hope you will be more ready to excuse my faults: however, if what I have done is acceptable to you, I intend a second Impression of this (indeed) small Treatise, to Correct, Illustrate, and Augment it, to its full proportion. In the mean while I would advise you to make use of what is here presented you, by your very humble Servant, Charles Allen.

FINIS

The Price is Six-pence.

This is exactly (with the word "indeed" fifth line from the bottom omitted) as it appears in the other editions, and what misled me to assume, in my previous article, that the 1687 edition was the first "impression" as he stated.

Following the "note" in Section VI, is the following "note":

Note, That in drawing out the old, or sucking Tooth, a great care is to be taken not to hurt the new one, lying under it.

Note further, That every thing is not capable of the same perfection, and that as there is no rule without some exception, so when I have asserted such and such things to be improvable to such a degree, it is understood for the most part and in general, not denying but that it may happen otherwise in some particular cases: but I shall always deal candidly with every body; never undertaking but what I can do according to agreement. And if any one will be pleased to come to my Chamber, he may have my Advice (concerning any thing that belongs to my profession) gratis at any time.

This is included in the later editions at the end of Section VII.

There are many changes in the text and improvements in punctuation in the later copies.

## SUMMARY

"The Operator for the Teeth," unknown before 1923, still appears to be the first dental book published in the English language. The 1687 edition, which I described in 1923, was preceded by two other editions. The one in Dublin, printed in 1686, differs from the 1687 edition only in a changed title page, "Curious Observations on the Teeth, etc."

There is now an earlier edition, not previously recorded in any medical or dental bibliography nor history, namely, that printed in York, in the year 1685,

by John White. Two copies are known of this edition, one owned by Theodor Blum of New York and the other in the York Minster Library. All three were the work of Charles Allen.

Though Charles Allen practiced in Dublin in 1686, he probably did not work under another operator. What his association was with Bannister, as mentioned by Mrs. Lindsay, must be further studied. It hardly seems likely that this Bannister could have been the one Allen had in mind "as my Master," mentioned by him at the end of Section II, and again in Section IV, unless Allen was a previous resident of Dublin before being in York in 1865. There is nothing to show that he was. We must turn to York for the information regarding Allen that we could not locate in Dublin.

I trust that Mrs. Lindsay and her associates will follow the "lead" now given and that they will be able to learn more regarding one of the earliest known English "operators for the teeth," and his "master."

Since we have had, for many years, a fairly complete record of the "first" dental book published in every language except English, it is difficult to understand why it has taken 245 years to obtain some record and knowledge of this work of Allen's. Why has no medical, dental or any other bibliography a reference to the 1685 copy printed in York, and to but a few of the other editions?

Since it was printed in three different cities of Great Britain, why is it that Hurlock, 1742; Berdmore, 1768; Ruspini, 1768; Hunter, 1771; Blake, 1801, and Fox, 1803, do not mention the first dental work in English or refer to Allen?

The study of dental history is as interesting and sometimes as mysterious and complicated as any novel in fiction.

119 West Fifty-Seventh Street.

# VINCENT'S INFECTION: MICROSCOPIC DIAGNOSIS

By FRANCIS H. DALEY, D.M.D., Boston, Mass.

IN order to make a positive diagnosis of Vincent's infection, it is necessary that the clinical diagnosis of the disease be substantiated by a thorough microscopic examination. This is not a generality: it is a hard and fast rule. Many cases may be correctly diagnosed without the aid of the microscope, but, on the other hand, many cases cannot be properly classified unless the microscope bears out the clinical findings. Trained men are often completely misled by some of these cases if the clincal aspect alone is studied. It is a well-known fact that other diseases of the oral mucous membrane may simulate a Vincent's infection, and the microscopic picture is essential in making a differential diagnosis.

Our microscopic diagnosis depends, to a great extent, on the smear and the staining of the smear and on the microscope itself. If the smear is thick, we have a smudge; if it is too thin, a proper diagnosis is impossible. The microscope should be equipped with the oil immersion lens in order that we get the proper magnification.

In reviewing the literature, we find that there is more or less dissension as to classification of the microscopic diagnosis. We classify as follows: (1) negative; (2) potential; (3) positive.

In making a diagnosis, we try, if possible, to have the patient present at the time the smear is examined microscopically. In this way, we are able to check up on the patient's clinical condition. This is important because, in this way, we can more properly evaluate the results and arrive at a better diagnosis than if we saw the smear alone.

Our first classification is negative: the slide may not show any organisms of Vincent's infection or they may be present in small numbers. If we are forced to search over the entire slide and find them widely scattered, we call the case negative. The fact that there are organisms present does not mean that the patient must have the disease. We seem to find them in many apparently normal, healthy mouths, particularly after a meal.

The second classification is potential. Here, we find the organisms scattered throughout the field; they are not in particularly large numbers, yet they give one the impression that they are amassing for attack. If the mouth shows indications of poor hygiene (tartar, etc.), we institute treatment and advise prophylactic measures. We feel that such cases, if left to run their course, will eventually develop the characteristic lesions of the disease. We also feel that it is much better to abort the condition entirely, if we can, than to wait until the tissues are attacked before treating them.

The third classification is positive. We find that a slide that is truly positive for Vincent's infection will give us a microscopic picture that cannot be mistaken. There will be a veritable network of *Borrelia vincenti* and the fusiform bacilli will be scattered throughout. If the smear is properly taken, we find practically a pure culture of the organisms. This bears out Cahn's statement. We have noted in such positive cases that the other bacterial elements of the mouth seem to diminish in number and as the borreliae and fusiform organisms are eliminated by treatment, they gradually return and are found in the smears.

Diagnosis depends on a study of both the clinical and the microscopic findings. One without the other is practically valueless, if we desire a diagnosis which is to be as accurate as is possible.

We do not discharge our patients as cured until all clinical symptoms have disappeared and until smears are negative for the organisms. We find, after a course of treatment, that, in many cases, the organisms are entirely eradicated. No doubt they will return, in small numbers at least, after cessation of treatment. Two weeks after we obtain the first negative smears, we have the patient return for a check up of the tissues. More smears are taken and studied. If possible, we have them back again in two more weeks and go through the same process. We have advocated this procedure for six years, and in an article published in 1927, this point was emphasized. Albray, in an article published in 1929 says, "I have not found a single writer who has stated that in cases which he has dismissed as cured, microscopic examinations were made to prove the mouth to be entirely free of the organisms which produced the disease."

### DARK-FIELD ILLUMINATION

A diagnosis can be made by using the dark-field illumination method. For the ordinary case, it is not necessary to go through this procedure. When there may be a question of concurrent syphilitic involvement, this method may be of value. *Borrelia vincenti* can be differentiated from the treponema of syphilis as the two organisms vary considerably

in their structure. The operator must be thoroughly familiar with the characteristics of the other spiral forms of the oral cavity which may be present in such smears. Some of these organisms so closely resemble the treponema that it is practically impossible to differentiate, conclusively, between them. If it is judged that *Treponema pallidum* is present, serologic tests must confirm the findings before the diagnosis can be said to be certain.

## DRUG REFORM—MEDICAL AND DENTAL*

By PAUL NICHOLAS LEECH†, Ph.D., Chicago, Ill.

IN 1905, the commercial domination of therapeutics in medicine reached its height. The number of proprietaries and unessential nonproprietary mixtures had reached enormous figures. And, worse, the advertising literature reeked with "unblushing falsehood and palpable deception."[1]

In the case of remedies sold to physicians, frauds were not altogether uncommon, and medical journals carried advertising teeming with statements which any chemist familiar with medicines would know were untrue. It was, as Dr. George H. Simmons has stated, not only the character of the preparations, but also the methods of exploitation, that had become unbearable and a disgrace to the profession that tolerated it. By 1906, a change had already been wrought. Organized medicine, in 1905, had created a body of unbiased scientists—men of high ideals and altruism—to advise the medical profession of and protect the public against fraud, undesirable secrecy and objectionable advertising in connection with proprietary medicinal articles. Overnight, as it were, the advertising pages of the official journal reflected the findings of that body of impartial specialists in the allied fields of medicine. Soon, too, other journals, particularly the state journals, cleaned up their advertising pages, now that there was an official group whose opinions were respected. The effects of the council's work were noticed in the winnowing out of undesirable proprietaries in the annual exhibit. Medical schools caught the spirit of emphasizing rational therapy, and the Council soon found it necessary to publish a book on useful drugs, which probably is the most widely used handbook of this character in the world. Even investigators brought forward problems on drug therapy, so that today the council has a therapeutic research committee to administer grants for investigation of debatable therapeutic problems.

By 1915, ten years later, the change that had taken place was indeed encouraging. Better preparations had been introduced, though the flood of unessential German synthetics was still a problem. Out and out frauds, as far as those ad-

*Read before the Second General Meeting at the Seventy-Second Annual Session of the American Dental Association, Denver, Colo., July 22, 1930.

†Director, American Medical Association Chemical Laboratory.

1. For interesting description see: Simmons, George H.: The Commercial Domination of Therapeutics and the Movement for Reform, J. A. M. A., 68:1645-53 (May 18) 1917.

dressed to the medical profession were concerned, were quite uncommon. False statements of composition of many remedies had been modified. There were still a goodly number of secret remedies, so-called ethical proprietaries, and, as always, there was still an overabundance of unwarranted advertising enthusiasm. But the final analysis of this period was that the profession of medicine was listening to the council, and many drug houses, though not all, were cooperative.

### CONDITIONS IN 1930

Now, in 1930, twenty-five years later, conditions are still more encouraging. Flooding of the market with unessential synthetics has passed. In general, the profession demands to know whether a new drug has received the "approval" of the council, and if not, why not. There are relatively few medical journals whose advertising pages are not decent. Practically all of the reputable pharmaceutic houses endeavor to have their new discoveries passed on by the council before they are presented to the practitioners. The old line of ethical proprietaries, such as Listerine, Sal Hepatica, Gude's Pepto-Mangan, etc., are either "patent medicines"—or dental nostrums. Not only are the number of new drugs fewer, but also the evidence necessary to gain recognition is much more exacting. "Careful control" is today the watchword of scientific drug investigation.

True, there is always a tendency to overstate, and when competition is strong, each house endeavors to find a proprietary that may possibly displace an official[2] (U. S. P.) drug, or a successful competing proprietary. Also impressive is the increased interest in rational therapeutics and prescribing; in colleges, in hospitals and in private practice, though there is still room for much improvement. Furthermore, American investigators are now in the front ranks in introducing worth while contributions to materia medica.

The method of introduction, too, is far superior to that of 1905. Thus, it may be succinctly stated that not only has the medical profession of America thrown off the yoke of commercial domination of therapeutics, but also it has gained in self-respect and prestige by having purged itself of much of the baser evils of irrational drug propaganda and therapeutics. So, too, has the standing of pharmaceutic houses of the better sort been enhanced. Such a change required fortitude on the part of the members of the council. It would not have progressed far if the better men of the profession and the teaching element particularly had not encouraged the reform; and, finally, the organization itself, through its journal and its advertising department, stood firmly behind the council. Was the effort worth while? *It was.*

### THE DENTAL SITUATION

So much for the medical field. Now, what of the dental situation? About four years ago, the officials of the American Dental Association, conscious of the proprietary evil, approached me in a consultative manner. Since then, the opportunity has been mine to observe the dental field as well as the medical field. This explains to you why I feel somewhat competent to discuss certain elements of dental proprietarism.

In my opinion, the proprietary evil and its ramifications in the dental profession

2. A drug which is included in the U. S. Pharamacopeia is official, and this book of standards is recognized by the Pure Food and Drugs Act; drugs not included are nonofficial. The nonofficial drugs may be either proprietary or nonproprietary.

as I found them three years ago were about as bad as were similar conditions in medicine twenty-five years ago. What were and what are they? One needed only to glance through the advertising pages of dental journals to note, with dismay, that there was lack of truthfulness in advertising. Simple or needlessly complex mixtures, masquerading under coined trade-marked names, were exploited to the profession with the claims of cure for pyorrhea or of being the superior anesthetic or antiseptic. Secrecy abounds in *dental* proprietarism. In my opinion, there is no profession more imposed on today than the dental profession. What, then, are some of the specific evils and abuses?

One needs only to refer to current advertising to note the evils. And when I make criticisms, as I must do tonight, please understand it is with the best interest of dentistry at heart. My purpose is not to criticize for the sake of criticism, but with the hope that hearing of these constructive criticisms and those of others, the profession of dentistry will hasten the work of ridding itself of the commercial domination of dental therapeutics as has the medical profession in its province. And I do not refer to drugs advertised only to the public, but to those addressed to the dentists themselves.

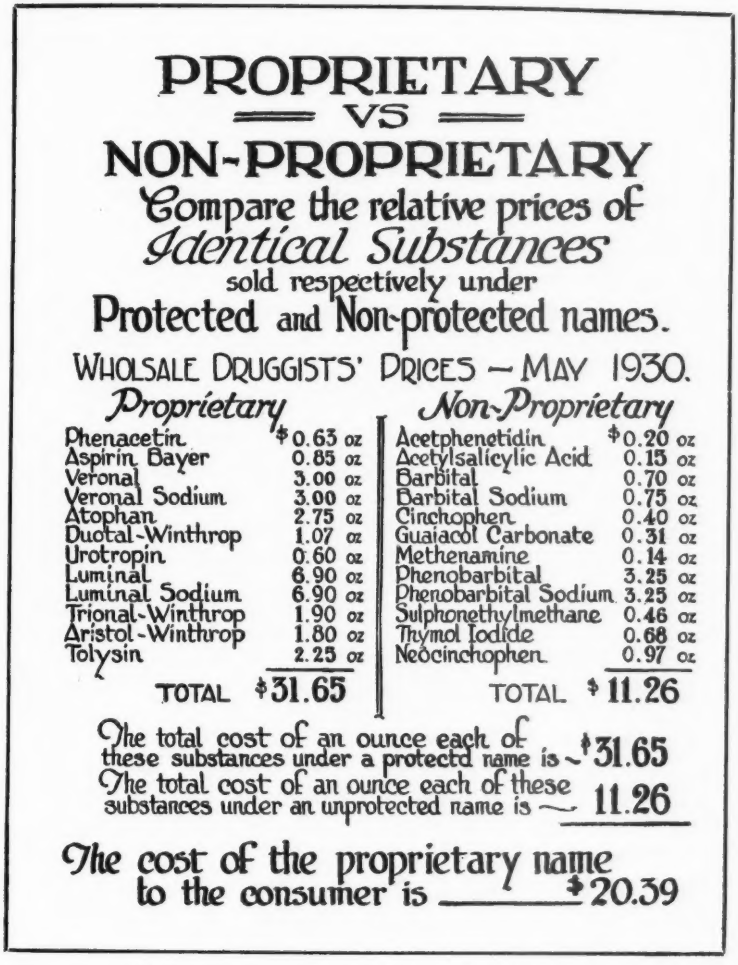
### ADVERTISING PAGES OF DENTAL JOURNALS

An evil that reflects greatly on the profession is the type of advertising certain dental journals carry. Even three years ago, THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION permitted secret proprietaries and blatantly worded preparations to use its pages. It is to the credit of the editor and certain Association officials that THE JOURNAL has cleaned its pages greatly, though there is still room for improvement. Then, the state and local publications have advertising of which the profession has no warrant to feel proud. Vastly worse, in my opinion, are the pages of some of the complimentary journals. The advertising pages reek with unacceptable proprietaries. Products which have not been admitted to the advertising pages of *The Journal of the American Medical Association* find easy entry in such dental journals—journals, it seems to me, devoted more to the interest of nostrums and proprietaries than to scientific dentistry. Yet there are those men in the profession, indeed reputable, though perhaps unthinking, who not only lend weight to such journals by reading them, but worse by contributing articles to them, and thus lending their names and even reputations to the furtherance of none-too-scrupulous publishers.

Sal Hepatica, Antiphlogistine, Ziratol, X-It, Analka, Ora-Noid, the Sherman L. Davis preparations, Mucol, Mu-Sol-Dent, Alkalol, Oxycystin, Peralga, Allonal, Novothesin, Agarol, Acrithesin, Odol, Neocultol, Perdentin, Efedron Hart, Zonite, Kojene, Camphophenique —these are just a few of the questionable preparations currently advertised in a dental publication. Quite a galaxy of secret remedies or unacceptable proprietaries not advertised in a method which reflects credit on the intelligence of the dental profession—none of these are acceptable for advertising in the official organ of medicine; do the dentists wish to be any less particular than physicians?

### UNTHINKING DENTISTS AS PROPRIETARY PURVEYORS

Just as open to criticism as the consent of certain dental publications to permit false or misleading advertising in their pages is the consent—with the best of in-




Differences in prices of proprietary and official drugs.

tentions—of practicing dentists to be used as professional purveyors of proprietary or "patent medicines." For instance, take the case of Anacin. The astute exploiter offers, under guise of a favor, to supply dentists with this mixture, unscientific and harmful in character, for the purpose of giving it away to patients. The unthinking dentist undoubtedly does this in all good spirit, believing that his patient will appreciate the courteous gratuity in the form of a remedy. The patient, having confidence in the dentist, does not suspect that this in essence is

what may be termed a shrewd and cheap way of reaching the public—using the profession, if you please. The patient is being imposed on as well as is the dentist. Yet what must be the reaction of the more informed layman when he finds that the product has been declared a fraud by the Government? Does it add to the prestige of the dentist? To offer comment to those of such intelligence as are within range of my voice seems superfluous.

May I give a personal experience? At the recent Detroit meeting of the American Medical Association, the wife of an official developed an abscessed tooth. She had it extracted by a man well recommended. The next day she returned to the office, according to instructions. The nurse examined the socket, and said, "If you have pain, here is an envelope containing some capsules." The patient discerned they were labeled under a proprietary name and inquired as to what was in them. The answer was, "Nothing harmful—just some salicylates"; whereas, in fact, the only statement on the label was that declaring the presence of acetphenetidin 2½ grains, a statement which the law requires because of its harmful possibilities. You can imagine how this patient's estimation of the dentist fell when she realized how he was being used, and, worse, that he had induced her to take a medicine of secret composition.

### SOME OTHER EVILS

There are many ramifications of the proprietary evil as it affects the profession of dentistry: Worthless or unscientific mixtures which have been thrown out by scientific medicine gain entry into dentistry; and, at times, there appears to be a tie-up between commercial houses and dental organizations, which the more intelligent of the laity are not slow to apprehend. The work already undertaken of exposing frauds by the A. D. A. Bureau of Chemistry will offset this, and, in time, when the public is convinced that dentistry is earnestly striving to protect the public as well as itself in dental matters, there will be noticed an appreciation, even in the halls of legislation.

There has been of late some doubt in my mind as to whether all this propaganda over the radio regarding seeing your dentist—an advertising subterfuge for exploitation of dentifrices—is not in the end going to hurt the standing of dentistry with the public. It is one thing to get the public dental minded through proper channels, for which your organization already deserves the greatest of credit. It is another matter to create dental mindedness by black-face comedians or popular humorists. In fact, shouldn't a learned profession such as dentistry object to being made a party to proprietary exploitation of this sort? Certainly it does not enhance the dignity of any profession if that profession does not protest against being misquoted or misused, whether it be toothpastes and dentists—or cigarettes and physicians!

Then there is the practice of permitting lecturers employed by commercial firms to appear before dental societies, with the result of introducing proprietaries into local practice.

Nor are scientific contributions on topics of drugs all that might be desired. Often men write, and dental journals accept, articles endorsing this or that proprietary, frequently given without the author's even knowing the active component. How can such contributions lend much to advancement of scientific dental therapy? In most cases, the profession gains nothing—but the proprietary house

smiles at the credulity of the author and the willingness of the journal to help him sell his wares. Concomitantly, rational drug therapy—so sorely needed—is not advanced. There are also those who give testimonials under uncontrolled conditions. Even some in high positions in dentistry today are permitting testimonials to be published for products that are in the rank of nostrums.

### PROPRIETARISM AS IT AFFECTS DENTAL ECONOMICS AND TEACHING

Finally, may I point out two more conditions, though there are many others. One deals with the economics of dental prescribing. There are many proprietaries which are either simple mixtures, or possess no advantage over the official article; yet the proprietary costs more. This increased cost is borne by the dentist and patient alike. In the interest of the patient, which is always paramount in a humanitarian profession, official products should be prescribed whenever possible. The difference in prices of proprietary and official drugs is shown in the accompanying illustration.

The second condition has to do with teaching of materia medica in colleges and schools. In some classes, the student is taught in terms of secret proprietaries, which cannot lead to accurate conclusions. If Blank's anesthetic is spoken of, how does the student know what component is doing the actual work? Or if Mucol is recommended, he has no conception that the action is essentially that of flavored salt and borax. To inculcate a spirit of scientific independence, the school must not be a party to proprietarism of the baser sort; and please note this: there are schools which, to my knowledge, are emphasizing rationality, and are not parties to the evil. But there are those whose teachers have not yet been awakened.

Indeed, dental schools there are where unessential dental proprietaries are nourished, and the nostrums, in some cases, carry the blessing of the school. Recently, the dean of a state *medical* school wrote me to the effect that he had been requested to speak before a local group of physicians and dentists on dental and medical quackery. He desired some up-to-the-minute examples. I suggested that he look in the school of dentistry of his own university where a member of the faculty who has made no outstanding scientific contributions was plagiarizing, in my opinion, the work of others, and using this as a basis for the exploitation under nondescriptive, proprietary names of such substances as the well known cod liver oil, some calcium and phosphorus containing compounds and other less scientific substances, with the seeming endorsement of the school.

Such, then, are some of the conditions, conditions which should and would disturb any self-respecting profession.

### A REFORMATION

But there has been taking place slowly a reformation in organized dentistry. It was under Dr. Banzhaf's presidency that it first took form. Then, after Dr. Pinney had assumed office as Secretary, arrangements were made for the employment of an American Dental Association chemist to work in the American Medical Association chemical laboratory. Some articles dealing with dental fraud, fakes or "patent medicines" appeared in the columns of THE JOURNAL. But this was not enough. These dealt mainly with products sold to the public. The work was constructive only by destruction. The purely constructive side, that is, recommending drugs which are serviceable and

honest, awaited a still further development.

At this point, may I emphasize that while the number of proprietaries which are imposed on the profession is vast, it is necessary for that dentist who intends to keep up with advancing dental therapy to use a few proprietaries. The great question confronting the progressive dentist is what proprietaries have promise of merit and are advertised in a way to warrant confidence. Other problems which require solving by an authoritative body of organized dentistry are the matter of aiding in cleaning up the advertising pages, not only of the official journal but of all other respectable dental journals; of knowing how to determine for the business management what products should be admitted to the exhibits at the annual meeting and in state meetings; of stimulating in the schools proper appreciation of worthwhile official drugs and overcoming the domination of commercial proprietaries; of advising the editor of the official journal concerning the status of a drug extolled by an author in a scientific contribution and, finally, being of service wherever possible to the dental profession, as far as it stimulates rational therapy.

### ORGANIZATION OF THE COUNCIL

This, then, is a big order. After much consideration, it was felt that nothing better could be done than to follow, for the present, in the footsteps of the American Medical Association and create a body similar in character to the Council on Pharmacy and Chemistry. Thus, last January, your organization undertook to form its own council on dental therapeutics. The scope adopted by that body is, indeed, important. Briefly stated, the function of this group will be to advise the dental profession concerning the status of proprietaries and nonofficial products. Those which are found acceptable according to its rules will be announced in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION and will be included in a list called "Accepted Nonofficial Dental Remedies." In addition, the Council is to make reports through the medium of THE JOURNAL on those products found *not* to be acceptable, and will advise the profession to avoid them and the reasons therefor.

The second general function of the Council will be to stimulate rational drug therapy in various ways by bringing to the attention of teachers, the propaganda of this Council; by suggesting a list of drugs which are useful in dentistry and by offering reports on therapeutic subjects for the benefit of the profession at large. Finally, its last function will be to encourage research which involves debatable therapeutic procedures. Not only is it necessary to educate the profession concerning the evils of proprietary domination, in contrast to proper therapeutics, but also to purpose that through its efforts, dental journalism, as reflected both in the advertising claims and in contributed pages, will rise to a higher plane.

### MEMBERSHIP OF THE COUNCIL; RESOLUTIONS OF TRUSTEES

The character of the group of men composing the altruistic body speaks for itself: 50 per cent of the men are nondental by profession, willing in the true scientific spirit to aid a sister science. The other five men are leaders in the dental profession. In addition, the Secretary, Dr. Pinney, is an exofficio member as is also the Editor of THE JOURNAL, Dr. Johnson, who has willingly given many of his pages to publication of this work. The advice of these two officials of the

Association is, of course, invaluable. The secretary of the Council is Dr. Gordon, a trained chemist and an adaptable executive. The roster of membership given here, therefore, speaks for itself: Samuel M. Gordon, Ph.D., secretary, Chicago, Ill.; Paul J. Hanzlik, M.D., vice chairman, professor of pharmacology, Stanford University, School of Medicine, San Francisco, Calif.; Thomas J. Hill, D.D.S., professor of clinical oral pathology and therapeutics, Western Reserve University, School of Dentistry, Cleveland, Ohio; Percy R. Howe, Sc.D., D.D.S., chairman, director, Forsyth Dental Infirmary for Children, Boston, Mass.; Charles N. Johnson, D.D.S., LL.D., Editor, JOURNAL OF THE AMERICAN DENTAL ASSOCIATION, Chicago, Ill. (exofficio); Milan A. Logan, Ph.D., instructor in biologic chemistry, Harvard Medical School, Boston, Mass.; Arno B. Luckhardt, M.D., Ph.D., professor of physiology, University of Chicago, Chicago, Ill.; John A. Marshall, Ph.D., D.D.S., professor of dental pathology and biochemistry, University of California, College of Dentistry, San Francisco, Calif.; Victor C. Myers, Ph.D., professor of biochemistry, Western Reserve University, Schools of Medicine and Dentistry, Cleveland, Ohio; John F. Norton, Ph.D., director, Bureau of Laboratories, Department of Health, Detroit, Mich.; Harry B. Pinney, D.D.S., Secretary, American Dental Association, Chicago, Ill. (exofficio); U. Garfield Rickert, A.M., D.D.S., professor of materia medica, therapeutics and hygiene, University of Michigan, School of Dentistry, Ann Arbor, Mich.; Harold S. Smith, D.D.S., Chicago, Ill.

Such a body, no matter how willing to work, cannot go far in its endeavors if the organization which created it does not stand foursquare behind it. Accordingly, at the February meeting, the Board of Trustees of your organization, adopted three important resolutions; namely, that

1. After July 1, 1930, advertising of proprietary remedies in THE JOURNAL will not be accepted unless the product and the advertising have been accepted by the Council, except in such cases as existing contracts legally obligate the Association to continue advertising copy until the conclusion of the contract.

2. The Business Manager be advised not to accept for exhibit in the commercial exhibit proprietary remedies which are not acceptable to the Council on Dental Therapeutics on and after 1931, and that, after 1931, journals carrying advertising matter relative to products not acceptable to this Council shall not be accepted as exhibitors.

3. No paper endorsing or introducing a new remedy will be accepted by THE JOURNAL until the Council shall examine the evidence submitted and publish a preliminary report.

To conduct its work of evaluating proprietaries, the Council has created a set of rules eminently fair. No proprietary manufacturer who has sufficient respect for the dental profession and desires to be honest should find anything to complain of in these rules. True, many of the proprietaries which are now foisted on the dental profession will be cataloged in their proper place. The rules are essentially the tried and true rules of the Council on Pharmacy and Chemistry, adapted to dental conditions. The Council on Dental Therapeutics requires that the composition of a product shall be declared; that there shall be no secrecy nor blatant advertising; that the methods shall be given for identification and to guarantee the purity of the product; that

no false claims as to the origin or unwarranted therapeutic claims, nor objectionable trade names, nor therapeutically suggestive names shall be given. Furthermore, no article shall be accepted or retained which, because of its unscientific composition, is useless or inimical to the best interests of the public or of the dental profession.

It is indeed noteworthy that this body created by the organized dental profession has the protection of the public at heart first and foremost, and, secondly, offers itself as an advisor to the dental profession.

### THE CRUX OF THE SITUATION

Now for the essential point of this discussion: You have been shown the improvement in the medical profession in the matter of proprietarism. There has been pointed out to you the evil effect of proprietarism in dentistry today, which no self-respecting profession can long tolerate. You have been told of the creation of a body whose purpose it is to aid organized dentistry in cleaning up the situation and in advancing the spirit of unselfish scientific research.

The crux of the whole situation then is: What are *you* going to do about it? Is there any reason why the dental profession should be more tolerant than the medical profession? I think not. Personally, I feel that the dentists have the public's interest as much at heart as has the medical profession; that dentistry is approaching an era in which the artisan side is merely one phase of dentistry, and the necessity for true research has become more and more apparent. The idealism of dentistry should be no less than the idealism of medicine. Even this Council group of self-sacrificing men cannot work single handed; if the work is to succeed, there are a few points to be considered as a final answer. The question is asked and is asked unfalteringly: *Are you willing* to stand by this work? If you are, when you are importuned by the retail man to use a proprietary, ask him if it has been submitted to the Council on Dental Therapeutics, and if not, why. Your time is too precious to trifle with imposters and parasites on the science of dentistry and the health of the public.

If you wish to use a new drug, find out what the status of that drug is, whether or not the firm has agreed to market the product in accordance with the rules of the Council on Dental Therapeutics. See to it that the officers and representatives of organized dentistry lend their full weight to its entire policies while it is in its formative stage, so the advertising department of the official journal and the state journals will have no hesitancy in refusing doubtful advertising. Encourage the editor of your journal in the work which has been done and give him renewed courage to be even more firm so that he may know the profession is back of him in refusing to lend his pages, either directly or indirectly, to advertising of nonacceptable proprietaries. Ask the Board of Trustees to take an interest in this work, not only by appropriations, but also by deserved encouragement. It hardly seems necessary to remind you of the enormous sacrifice of time which will be required of these men on the Council, men of the highest scientific attainments and integrity, who receive no remuneration at all. While each owes something to his profession, an inordinate amount of work is being requested. Consider then, in addition, the extraordinary amount of work and time which the nondental members are willing to undertake in this work for you without remuneration.

On February 1, I reported to your Board of Trustees that my connection with this work was finished, as the two years during which it was to be guided had expired. There was one point that I urged most strongly; namely, that at no time should political consideration enter in reference to this Council, and that if, at any time, anyone for the purpose of aggrandizement or self-glorification, should use, or abuse this body for political purposes, he should, in short order, be set aright.

"YES" OR "NO"?

Again I ask, are you willing to lend your aid to this useful work? Will you take more than simply a passive interest? The crossroads have been reached for you to determine whether this work is worth while and is sufficiently important to demand your wholehearted support. You owe it to these unselfish men to tell them "Yes" or "No," because their time is entirely too valuable to be spent on an unappreciative profession. I personally believe that you are not unappreciative, and if I sense the feeling of this meeting aright, I believe that not only will you support it, but, twenty-five years hence, you will say of your Council on Dental Therapeutics, as the American Medical Association today says of its Council on Pharmacy and Chemistry, "It is one of the crowning glories of the organization."

# ACUTE INFECTIONS*

By FREDERICK B. MOOREHEAD, M.S., M.D., D.D.S., Chicago, Ill.

THE prevention, recognition and treatment of infection is the principal obligation and challenge of physician and dentist alike, and every infection should be looked on as more or less harmful. The degree of damage may be immediate or remote, general or local. Infection once established furnishes an opportunity to the physician and dentist to limit the damage to an irreducible minimum. Any failure to do this is embarrassing to the doctor and to his patient. An acute social sense is as important as selective training, and the function of the doctor is the measure of his stewardship.

While the various mechanisms of resistance are theoretically well known, clinical judgment is the only item of practical value. To measure with reasonable accuracy the end result of a given infection is one of the finest phases of the fine art of all medicine. To guide his patient through infection with the minimum of damage is the responsibility and the pleasure of medical and surgical service.

The onset of every infection furnishes significant data. The balance between safety and danger, general and local, is recorded in the patient himself. A minor local reaction with a major general reaction indicates general danger. A major local reaction with a minor general reaction indicates local danger. In one case, the patient is to be protected, while, in the other, the part involved is to be

*Read before the Section on Oral Surgery and Radiography at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1930.

protected. In one case, the patient is clearly ill. He has a high temperature, rapid irritable pulse and is more or less apprehensive. In the other case, there is little change in temperature or pulse rate, and he does not feel ill, even though there may be considerable local disturbance.

With these thoughts in mind, I have selected for discussion the following items as being not only of special interest but also, at least some of them, more or less serious in character:

### INFLAMMATION OF THE MUCOUS MEMBRANE

*Acute Ulcerative Gingivitis (Gilmer).*—In American literature, the term "trench mouth" is frequently given this condition. It is characterized by a rather sudden onset, with progressing ulceration of the gingivae and considerable pain. Spirochetes and fusiform bacilli are found in the gingival lesions. It is doubtful that these organisms are the primal cause of this form of gingivitis; it is more likely that the symbiotic relationship between these and other organisms, principally the streptococcus and staphylococcus, is responsible. The aggressive character is probably due to the cocci, and the necrotic and gangrenous process is produced by the spirochetes and fusiform bacilli. Predisposing factors are undoubtedly found in unfavorable hygiene and diet.

*Vincent's Infection.*—This is an acute pseudomembranous, ulcerative pharyngitis or tonsillitis, associated with swelling of the lymph glands. The condition may resemble diphtheria and occasionally it spreads forward over the mucous membrane of the mouth. The organisms are again the fusiform and the spirochete. Jochmann believes that the spirochete of Vincent's infection represents a specific pathogenic type of the spirillum forms.

*Gangrenous Stomatitis or Noma.*—Noma is a rapidly progressing infection of the cheek, occurring chiefly in children who are undernourished. It may occur in conjunction with the acute infectious diseases. While noma is a relatively rare disease, the mortality is about 70 per cent.

*Ludwig's Angina.*—This is an acute phlegmonous inflammation of the floor of the mouth, probably starting from the salivary glands or lymph nodes surrounding the salivary glands. The putrefactive organisms from ulcerous processes of the mouth enter the lymph channels of the gland. After breaking through the capsule, they quickly involve the surrounding tissues, forming a phlegmon of board-like hardness. The phlegmonous swelling may extend to the lower regions of the neck and even involve the mediastinum. Death frequently occurs from sepsis and edema of the glottis.

### ALVEOLAR ABSCESS AND ITS SEQUELAE

The alveolar abscess has its origin either in the periodontium through contact with the surface or, much more frequently, forms at the root-end through invasion of organisms by the root canal. Here, we see, as elsewhere in the body, suppurative processes from the mildest to the gravest. There may be extensive localized swelling and pain, and there may be serious constitutional reactions with fever and rapid pulse. In alveolar abscess, the pus usually finds its way to the outer surface through the buccal or labial plates and rapidly involves the surrounding soft structures. We wish to emphasize certain departures from the usual course of the simple alveolar abscess: First, the pus may find its way through the lingual plate and give rise to an involvement of the floor of the mouth, or the palate, as the case may be.

We have been impressed the past few years with a relatively large number of cases of alveolar abscess in the molar region of the lower jaw, in which the pus found its way through the lingual plate and passed backward to the tonsil region, producing what we have termed a subtonsillar abscess. The abscess usually forms just in front and below the tonsil, producing an extremely large swelling, with attendant pain, difficulty in swallowing, inability to open the jaw, etc. These patients are usually more or less definitely ill. There is not a great amount of external evidence. The swelling in the soft tissues over the jaw and in the neck region is limited. While these abscesses rupture spontaneously and the patient is relieved, much suffering may be avoided by the early recognition and opening of the abscess.

Probably the most painful type of alveolar abscess is the one in which the inferior dental nerve is directly involved. Cases of septic neuritis may continue for weeks, with extreme pain, sometimes so severe that even large doses of morphin are impotent. The alveolar abscess may again rupture into the nasal cavity without producing the usual amount of swelling in the overlying tissues within the mouth. Abscesses forming in the upper jaw in the bicuspid and molar regions may penetrate the maxillary sinus, although, for some reason difficult to explain, this is rather rare, notwithstanding the proximity of the roots of these teeth to the floor of the sinus.

The subperiosteal abscess, probably least often recognized of all of the various types of alveolar abscess, is most likely to do definite and sometimes very serious injury to the bone. The pus, in finding its way to the outer plate, will meet a thick periosteum loosely attached to the bone, and, instead of penetrating the periosteum, will collect beneath it, sometimes stripping it from the bone over a large area. The periosteum may be stripped from the external aspect of the jaw or the pus may burrow under the jaw and involve the lingual aspect. A subperiosteal abscess differs clinically from the simple alveolar abscess in that the cellulitis is more diffuse, and there is practically always an absence of fluctuation. Patients are frequently put to bed with hot packs, and days may pass without any attempt at locating and evacuating the pus. Necrosis of a limited area may follow, or the entire outer plate may be destroyed, and we have seen several cases in which there was total necrosis. Once the vitality of the bone is destroyed, suppuration will continue, multiple sinuses frequently forming, with excessive scar formation and retraction of the skin at the site of the sinus or sinuses after exfoliation of dead bone and healing. These areas, too, may become pigmented permanently. By far the larger number of subperiosteal abscesses are found in the lower jaw in the region of the angle, and a large number of these are connected with the lower third molar, particularly the submerged type, some before, but mostly after, removal of the tooth. It is our observation that most of the serious suppurative infections involving teeth are connected with the lower molars. The bony encasement of these teeth and the fascial complexity probably explain this fact. Clinically, the difficulty in management increases from the second bicuspid to the third molar.

## SEPTICEMIA

Among all the serious infections, septicemia is one of the most grave. While the tissues of and about the mouth are high in resistance, the organisms pro-

ducing septicemia may gain admission through these parts. Because of this fact, any carelessness or inefficiency in handling these tissues is to be severely arraigned and the relative infrequency of septicemia does not reduce responsibility in the premises.

### ACUTE LEUKEMIA

Acute leukemia is a disease characterized by an increase in the number of leukocytes, associated with hyperplasia of leukoblastic tissues. It occurs in younger persons, and more frequently in males. In onset and course, the disease resembles an acute infection. Swelling of the tonsils, ulcerative angina, stomatitis, fever, hemorrhages and a rapidly progressive anemia are the dominant features. Dyspnea, nausea, vomiting and diarrhea are not uncommon. Some cases resemble purpura fulminens, and cutaneous hemorrhages may be present before the patient falls ill. The glands of the neck enlarge, but death may occur without this symptom. The spleen is usually palpable. The course is rapid, and death usually occurs within a week or two.

Jaffe[1] emphasizes the distinctive diagnostic feature in the presence of abnormal cells in acute leukemia, disregarding the presence or absence of leukopenia or leukocytosis. There is a pronounced immaturity of either all, or at least the majority, of the white blood cells.

Minot[2] states in detail that this abnormality of the cells is detected particularly by the character of the inner structure of the nucleus, which will show nucleoli. In infectious mononucleosis, markedly immature cells have been recorded. He says that, with a little experience, one can readily distinguish the predominating cells found in infectious mononcleosis from those characteristic of acute leukemia.

It would seem that the most constant of the physical findings, and possibly the most important, is the glandular enlargement. This is usually very extreme, in the cervical axillary and inguinal glands.

Fallis,[3] in reviewing several cases, cites the usual picture of a severe infection, but states that many cases do not show glandular enlargement at the onset. He says that the blood picture shows a relatively high polymorphonuclear cell count, which, within a few days, is replaced by a high lymphocyte count, which dominates the picture, the lymphocytes ultimately constituting from 90 to 97 per cent of the white cells present. The character or immaturity of the cells is the differential diagnostic feature.

### AGRANULOCYTIC ANGINA

Agranulocytic angina is a clinical syndrome first reported by Schulz of Berlin in 1922. The literature, closely following this recognition, reports a few series of cases. Of late, cases have been cited more frequently, as the syndrome has become more definitive.

*Etiology.*—Though the etiology seems to be obscure, the consensus of opinion seems to be that the disease is not a distinct entity; at least, no specific agent has been found. The cases reviewed resemble closely the picture prescribed by any overwhelming infection in which there occurs a neutrophilic leukopenia. Zikowsky, Friedman and Stile are cited as outstanding observers who believe that the symptoms are produced by a chemical or biologic toxemia.

1. Jaffe, R. H.: Arch. Path. & Lab. Med., 3:56 (Jan.) 1927.
2. Minot, G. R.: M. Clin. N. America, 13:1 (July) 1929.
3. Fallis, W. E.: Kentucky M. J., 26:180 (April) 1928.

*Symptomatology.* — Tynes,[4] in his review of the symptoms in a series of cases, found agranulocytic angina occurring chiefly in middle-aged women. He found the diagnoses distributed as follows: sore mouth and throat, thirty-two; diphtheria, twenty-five; jaundice, twenty-five; malaise, fourteen. The mode of onset was acute, the condition developing in a period of good health in twenty-eight, while, in the remaining fifteen, the acute manifestation developed after a protracted period of ill health. The temperature range at the onset of recognition was from 101 to 105 F. Exhaustion developed early, and coma often preceded death.

Enlargement of the liver and spleen were observed but were not constant. The average duration of the illness was from two to eight days, while the extremes were from two to forty-two days. In the forty-three cases, the mouth always showed an inflammatory process. Ulceration and necrosis were most frequent, including the tonsils, throat, gums and extending into the larynx and esophagus. There were frequent enlargements of the cervical lymph nodes.

Franken and Hensel[5] observed that most cases are accompanied by mouth lesions, comparable to those seen in Vincent's infection.

Rose and Houser[6], in a résumé of many cases, found that the lesions common to the various organs were small patches of necrosis without cellular reactions. There was widespread necrosis of the walls of smaller arteries and veins, and a complete absence of leukocytes, even in the bone matter. Areas of inflammatory edema were found, especially in the upper respiratory tract and skin.

All three cases reported by Trace[7] showed agranulocytic-ulcerative angina with a marked neutrophilic leukopenia.

Kopelowitz[8] expresses a common opinion in stating that the most striking finding, and all important in diagnosis, is the blood picture, a leukopenia with a marked depression or absence of polymorphonuclear leukocytes and the presence of a relative lymphocytosis. There is no hemorrhagic tendency.

The diagnosis seems to be easily made by the blood examination. There are several conditions that must be differentiated; namely, acute leukemia or poisoning with thorium, arsenic, benzol or the roentgen ray.

In acute leukemia, the leukocyte count is, as a rule, high, 50,000 or over; and a hemorrhagic tendency is usually present at some stage. In poisoning with thorium, arsenic, benzol and the roentgen ray, a history of employment of such agents or exposure to them is obtained.

Acute leukemia and agranulocytic angina, although classified as general diseases, are of direct interest to those primarily interested in diseases of the mouth, because of early marked mouth involvement in both diseases, particularly in agranulocytosis.

## CONCLUSION

In this brief review of some of the more common and also some of the more serious infections which interest those responsible for the health of the mouth tissues, attention is called to the fact that none of us can afford to be either academically or clinically unsophisticated.

30 North Michigan Avenue.

4. Tynes, A. L.: Virginia M. Monthly, 55:765 (Feb.) 1929.

5. Franken, S. W. A., and Hensel, O.: The Dental Cosmos, 71:1056 (Nov.) 1929.

6. Rose, E., and Houser, K. M.: Arch. Int. Med., 43:553 (April) 1929.

7. Trace, I. M.: Illinois M. J., 36:38 (Jan.) 1929.

8. Kopelowitz, J. C.: J. Missouri M. A., 26:320 (July) 1929.

# OPERATIVE TECHNIC FOR THE GENERAL PRACTITIONER IN THE TREATMENT OF PERIODONTOCLASIA*

By M. H. GARVIN, D.D.S., Winnipeg, Canada

THE problem suggested by the subject is, in part, an economic one. C. N. Johnson states, in a recent paper entitled, "A Survey of Present-Day Dentistry," that "the people must have the benefits of specialization and they must have them at a cost that is not prohibitive," and again, "it is costing the people too much to be ill."

This is not a local problem: it is a world problem. In India, for instance, there are about 320,000,000 people. If this population were to pass a given point, four abreast, passing at the rate of twenty rows per minute, night and day, it would take seven and one-half years for them to pass. In the United States of America and her possessions, there are about 112,000,000 people, about one-third the population of India, but even that is a great multitude. For a moment, try to visualize the periodontal problems of these people. In India or China, with a still greater population, and countries similarly situated, we might well throw up our hands in despair. In America, the situation is not hopeless, but it is acute, presenting a great problem for the dental profession.

Throughout the world, America stands first in the progress made in dental science, and in its service to the public; but the most casual survey of the situation impresses one with the fact that there are very large numbers of our people who do not receive sufficient dental service, if any at all. Is this due to a scarcity of dentists, to a lack of education, to inability to pay our fees or to inefficiency in the conduct of the average dental practice?

Consider briefly some of the facts. It is said that 86 per cent of all incomes in the United States are below $2,000 per annum; in other words, the majority of self-supporting families are living on a little less or a little more than $2,000 a year. For a moment, let us consider the case of the man with a wife and several children, and an income of $2,000 a year. This man has other dental problems besides periodontal disease; his wife and children also need dental service. The amount left for dental and medical care after the other necessities of life have been obtained is very small. People are economizing on dental service, and particularly preventive service, because they think they must, and this is probably true of a large group of spenders the world over. Even the man with a $4,000 or $5,000 income is confronted with these same conditions.

Great men are thinking in terms of service these days. In a letter received by me a few months ago, a friend of mine, a dentist in Toronto, said, "I am giving

*Read before the Section on Operative Dentistry at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1930.

my chief thought these days to dentistry for the poor." This speaks well for the solution of a definite difficulty which exists in our professional life of today.

In the solution, of course, the other side must not be overlooked. There is the high cost in time and money to the dentist, in procuring his education. It may not be possible to reduce this, but if not, every assistance should be given to the graduate in the nature of hygienists, mechanics and trained assistants, so that as much as possible may be accomplished in as short a time as possible, and thus overhead costs be reduced and dental service be rendered at a fee within the reach of more than 10 per cent of the people.

Another problem is the cost of dental equipment, appliances, instruments and materials, which should be reduced in some way if possible by an institute of research, which should be established to bring about a reduced cost of dental service to the public.

There is a problem which becomes obvious as one attends various clinics and conventions and observes that the emphasis is almost always placed on perfection of technic, regardless of time and expense, instead of on the questions as to how to insert a filling or a bridge or clear up a periodontal condition in the shortest possible time. The vision of the dental profession is being tested.

Under the influence of educational propaganda, the public is gradually awakening to the necessity of procuring adequate dental service at a cost within its reach. Even now, a socialized dental service is developing in many centers.

The public must be made to see that adequate dental service, particularly preventive service, is a necessity and must be obtained even at considerable sacrifice. On the other hand, the dentist must meet this need fairly, not by increasing fees to the breaking point, but by adopting an efficient system of practice that will be as satisfactory to his patient as to himself.

Office equipment should be modern but not overdone. Instruments should have the appearance of being new, and should be sharp and always in their place. There should be several of each kind of instrument that is commonly used, and not to have these is false economy. In using periodontal scalers or curets, when the operator lays one down to pick up another shape, the temporarily discarded instrument should be placed in a glass tray containing some colored antiseptic solution, such as a solution of potassium permanganate. This will keep the instruments clean and keep them in better condition for placing in the sterilizer. This practice is also more acceptable to the patient. The busy dentist will also have at least one hygienist and one or two woman assistants if he is going to retain that poise necessary in the time of crisis, and if he is going to be able to render adequate service at a reasonable cost.

In the handling of a periodontia patient, it is suggested that twenty minutes only be allotted for the first appointment. The patient may complain of bleeding or sore gums, of some ache or pain, or other pathologic condition. Apart from relieving pain, the first step should be to determine what roentgenograms are required. After testing the teeth for vitality and exploring the depth of the periclasia pockets, we are in a position to decide how many pictures are necessary. While a full set is usually ideal, in many cases this service can be limited to pulpless teeth, teeth with fairly deep pockets and areas where teeth have been extracted. When the roentgen-ray requirement has been determined, the next step in dealing with this patient is to

obtain his consent to have the pictures taken. This can best be accomplished by showing pictures and charts, and explaining how the various forms of disease are expressed and the possible effect on the health of neglecting these conditions. Few people know the value of the roentgen-ray in dentistry.

At this first sitting, a brief health history may also be obtained. The roentgenograms are now taken by the assistant, and while they are being developed, the hygienist may give a prophylactic treatment, which is one more forward step toward bringing modern dental service within the financial reach of an ever-increasing number of needy patients.

At the second appointment, we proceed with a very careful clinical examination of the teeth and periodontium, noting the nature of the occlusion, observing the teeth in function, testing for mobility, noting anatomic irregularities of position and form and recording all carious areas, exposed pulps, defective contacts, erosion, abrasion and imperfect restorations of every kind, also the nature of the deposits and the pus that may be present. In complicated cases, study casts may be obtained. A bacteriologic study of the pockets would prove interesting. The latter should be the duty of an assistant. I am of the opinion, as I have stated in a previous paper, that the future will show that the spirochete plays a much greater rôle in this disease than it has been given credit for.

Having examined the roentgenograms and perused carefully the clinical findings, one is now in a position to make a thorough diagnosis. The pulpless teeth must receive due consideration. The type of reconstructive work must be decided on, with the financial status of the patient in mind. It is well to work out several plans, giving estimates on each, describing carefully to the patient the steps involved. Models, pictures and charts should be used to show him the depth of the periclasia pockets. I employ an obtuse angle explorer with an 8 mm. blunt point for this purpose and I have the patient look in a mirror actually to see the amount of bony absorption that has taken place. Take the patient into your confidence, for even though you may be the best technician in the world, this ability is of little value until the patient knows it and appreciates it.

Whether the patient agrees to accept a type of treatment involving gold inlays, fixed bridges, porcelain crowns and the most conservative type of periodontal treatment, or whether he agrees to the extraction of a number of teeth, the insertion of partial dentures and the treatment of the periclasia by the radical and quicker method, the patient has had a thorough examination, and, when the work is completed, will have a mouth free from any known infection. This is of paramount importance. A patient should never be dismissed with numerous foci of infection in the mouth, most frequently found in periclasia pockets, more or less deep.

In the treatment of periodontoclasia, it must be rememembered that if a systemic disease is present, it must be taken care of, and this will probably involve the cooperation of a physician and the postponement of the dental service until the physician considers it wise to proceed. On the other hand, it is often unwise to proceed with systemic treatment until the grosser forms of infection are removed from the mouth. Faulty habits of worry, work, lack of exercise, etc., must be corrected. The problem may be a dietary one. Within certain limits, the dentist should be able to prescribe foods that will build strong dental organs and a

healthy periodontium. All local causes such as tartar, traumatic occlusion, overhanging fillings and crowns, poor contacts, etc., must be eliminated.

After the hygienist has given a prophylactic treatment, we proceed with the removal of all teeth marked to be extracted, with the exception, in some cases, of the anterior teeth, which may be kept temporarily for esthetic reasons. Then we correct the traumatic occlusion before commencing the apoxesis, since postponing the correction until after the apoxesis of the root surfaces means the unnecessary prolongation of the treatment. It may be necessary to complete some of the restorative work at this point in order to produce, as quickly as possible, a physiologic occlusion.

If we have decided on the conservative method of periodontal treatment, we proceed with the following steps as so ably outlined by Harold K. Box: (1) scaling, (2) cemental curettement, (3) periodontal curettement, (4) establishment of the blood clot and (5) sealing of the pocket.

It is not the object of this paper to discuss minutely the nature of this conservative treatment, a treatment which conserves the maximum amount of tissue, and which will result, in many cases, in the elimination of the pocket by reattachment, if the background is favorable, the patient willing to cooperate and the operation exactly performed. If reattachment does not occur, the operation must be repeated, for periodontoclasia is not cured or even arrested until the pockets have been obliterated.

This conservative treatment is probably the ideal treatment where satisfactory results are obtained, but it is a great time consumer and consequently costly. The object of this paper is to consider periodontal treatment for the average citizen, the man with a modest income, who has already been described. If this patient has even a semiadvanced condition of periclasia, I would advise treating it by the more radical method, either laying back a flap, curetting the diseased bone, removing hypertrophied gum tissue, and trimming and then suturing the flap in position; or the still quicker method of excising the gum tissue to the depth of the pocket, curetting, etc., and covering with some surgical cement to be left on for several days. If this excising is artistically performed, the final appearance is very satisfactory, and it can be done with the minimum consumption of time. There is rarely a problem from the esthetic standpoint except in the case of the upper anterior teeth. Even in these cases, the pockets may frequently be eliminated or reduced considerably by surgical means. If the lip is long and the teeth do not show much, or the teeth are short and the gum protrudes over part of the crowns, such surgery presents no problem. In other cases, the flap operation is to be preferred. If the buccal plate of alveolar bone in the bicuspid or molar region projects upward so as to form a deep pocket in the bone buccolingually, this buccal plate should be reduced with a chisel in order to obtain drainage for the pocket.

A mouthwash such as sodium perborate, a quarter of a teaspoonful to quarter of a glass of water several times a day, should be prescribed or one of the proprietary preparations which have a high oxygen content and which are more stimulating and taste better than pure sodium perborate. At a later sitting, and particularly after the restorative work is complete, the exposed surfaces of the teeth should be carefully polished with a wood point and some mild abrasive.

Another consideration that impresses one in favor of the radical operation, rather than the conservative operation when time and expense are factors is the fact that there is much less chance of recurrence of the trouble following the radical procedure than when the conservative method is followed. In my practice, this has been borne out in a great many cases.

Whatever type of periodontal treatment is adopted, whether it be conservative or radical, one must have 100 per cent cooperation of the patient if ideal results are to be obtained. The patient is told that he must brush his teeth properly and is shown how to do it, first on a model, and then in his own mouth, and preferably by a hygienist. He is further told that he must return for examination and prophylactic treatment every three months. His name is placed on the prophylactic list and in three months he is notified by telephone, not by letter. This has proved a great practice builder and a great practice stabilizer.

In this problem with which one is faced, the education of the patient is a necessity. Much splendid work has been done, but there is still a tremendous amount to be done. In this problem, there is the question of the cost of equipment and supplies. There is also a great need to educate the profession along lines that are economically, as well as ethically sound, bringing about a condition under which the average dentist will receive not a smaller income, but a larger one, because, in many cases, he will be practicing with a group of dentists, his overhead will be reduced, he will have more assistants to help him to a greater service, and he will have developed a technic which will permit him to do much more work in a given time, with the result that he can work for a much larger number of people and at a lower fee rather than a higher, if that be necessary in order to bring the golden field of dentistry within the reach of a vastly greater number of our average citizens.

This is not an impossible goal. Julius Caesar would have regarded it as impossible to flash his famous *"Veni, vidi, vici,"* to the senate by wireless. It wasn't, but he did not know how to do it. Nero never dreamed of riding down the Appian Way in a motor car. Napoleon would have considered it impossible to cross the channel in an airplane. It wasn't, but he did not know how. "The next step in human progress is always an invasion of the territory of the impossible," and we may count on opposition. Every innovation has to fight for its life. Every good thing is condemned in its day and generation. Even as great a man as John Ruskin foresaw that the railroads would ruin England by driving the stages out of business and killing the demand for horses, thus ruining the farmer. Thus we see that progress is made in the face of opposition. "Kites rise against, not with, the wind." What we need today are men and women with a vision.

314 Somerset Building.

# IS INFECTION THE ONLY DANGER IN ROOT CANAL THERAPY?

By FERDINAND G. NEUROHR, D.D.S., New York City

AN article by Howard Temple Stewart describing a new root canal procedure appeared in the March issue of THE JOURNAL. It is because this article was accompanied by favorable editorial comment; because it made an impression on some of the outstanding men of the profession, and because so many will grasp at anything new in this field in view of the unsatisfactory results which so often follow the use of even the best of present day methods, that I have taken it on myself to sound a warning by reporting the findings in each of the two cases treated by this technic which have come to my attention.

In taking the history of the case and examining the pictures shown in Figure 1, it was found that the canals were enlarged, that they were allowed to drain for a period of many weeks and that the canals, and, for that matter, the surrounding tissues, were finally overfilled as described in Dr. Stewart's article.

Fig. 1.—Roentgenograms taken eighteen months after canals were sealed; showing overfilling and enlargement of root canals as advocated by Dr. Stewart.

It is not my intention to enter a discussion at this time as to whether a pathologic condition is or is not present or whether such a condition was present in the beginning. The premise that I do wish to offer, and as to which there can be no question, is that the introduction of foreign bodies into living tissue is generally undesirable. When, in addition, it is impracticable, if not impossible, to remove such substances when occasion requires, the procedure of introducing

such foreign material becomes, to say the least, a highly dangerous one at best.

Suffice it to say that because of considerable discomfort on the part of this patient, five of these teeth were extracted, and that it was only after experiencing the greatest difficulty in the removal of the overflow root-filling materials that this condition was abated.

Fig. 2. — Tissues immediately after the usual extraction procedure, which allowed soft amalgam to remain.

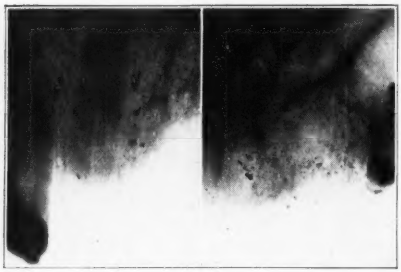


Fig. 3. — Roentgenograms showing how amalgam scattered into the apertures of the aveolus; unsatisfactory results but the best that could be had without radical bone excision.

Infiltration anesthesia (procain) was used. The teeth, although extracted with extreme care, unfortunately separated from the excessive filling material, leaving it behind. No concern was felt at this time as I was confident that, by means of the usual granuloma excision procedure, they would be easily removed. Imagine my surprise when I found the material in an extremely plastic state, although it had been in place for over a year. It was even softer than what we term a "sloppy" mix of amalgam. The slightest pressure with the curet, although full access had been secured by the removal of the buccal plate, would squeeze this material into the cancellations of the alveolar process. Figure 2 shows the roentgenograms which were taken at this time. To remove this material was like trying to pick mercury from a carpet.

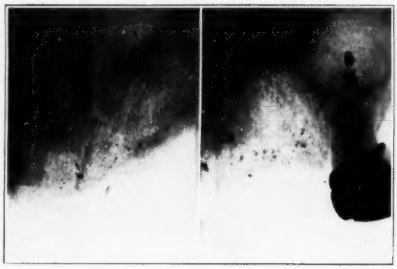


Fig. 4.—Roentgenograms taken one year later. (Compare Figure 3.)

Every time an attempt was made at curettage, the mass would scatter and spread throughout these bony apertures. It was only after an hour and a half of painstaking effort, and after a considerable amount of the alveolar process had been removed, that I was finally able to attain the result illustrated in Figure 3. Even this, of course, was most unsatisfactory as part of the filling material still remained, but better judgment dictated that we had gone far enough at this time.

Figure 4 is a roentgenogram of this case taken one year later. Some of our

leading oral surgeons agree with me that while the condition in these areas is anything but satisfactory, to effect the complete removal of the material would require considerable bone excision, a thing to be avoided if possible.

Figure 5 shows films of the other case, also treated by Dr. Stewart, which has come into my hands. In this case, the filling penetrated into the inferior dental canal. Although much was removed, it is unnecesary to state how impracticable, to say the least, it was to remove all of it.

a b c d

**Fig. 5.—Case in which the filling material had been forced into the inferior dental canal. *a*, before extraction. *b*, immediately following extraction. *c*, after considerable curettage. *d*, piece of amalgam lodged in the inferior dental canal which it was found impossible to remove without radical operation.**

It may be that the human tissues will, under certain conditions, tolerate a bullet by encystment as Dr. Stewart has pointed out, but, in my opinion, knowing the consequences so often following such a misfortune, particularly when it enters the bony structure, it is foolhardy indeed to use this uncertain tolerance of the tissues as a criterion and deliberately insert metal of any kind into the maxillary bones. Particularly is this true of such amalgams as are described by Dr. Stewart, which, owing to their plasticity and the environment in the jaw, cannot be easily and completely removed by a reasonably simple operation when necessary.

It does not take much imagination to conceive the position that the dental profession, to say nothing of the public, would find itself in, if this root canal procedure as outlined by Dr. Stewart should be accepted and practiced by dentists all over the country. Would not we of the dental profession have something serious to answer for when the time came that these teeth must be extracted? What a predicament—to have deliberately inserted a foreign body into the tissues of thousands of human beings and then not to be able to remove it!

# ADVANTAGES OF CLOSED MOUTH MUSCLE ACTION FOR CERTAIN STEPS OF IMPRESSION TAKING*

By R. O. SCHLOSSER, D.D.S., Chicago, Ill.

STRICTLY speaking, no method used in the past or present can rightfully be termed a purely closed mouth technic, for all methods require that the patient's mouth be opened occasionally, not only for the introduction of the impression mass, but also during its subsequent manipulation.

It is true that we have had dissertations and discussion on the relative merits of the open and of the closed mouth method, accompanied at times by the injection of personal opinions, some of them based on enthusiasm bordering on the fanatical. It is high time that a halt be called on such childish procedures in our dental gatherings. These useless arguments have occupied entirely too much time at our meetings, and, worse yet, have cluttered the pages of our dental journals to such an extent that we wonder at the editorial judgment that permits them to be published. We might include, without much fear of dispute, that this editorial laxity has allowed grotesque claims relative to other technical and operative procedure, as well as to materials and instruments, to be broadcast on the pages of our monthly periodicals and state publications.

I hope that what I am about to present will be accepted in the spirit in which it is offered; namely, without prejudice or favor, but for its intrinsic worth, as statements based upon experience of more than twenty-five years in office and clinical practice in the taking of impressions of fully edentulous mouths. For more than fifteen years, I have taken virtually all my impressions in modeling compound, yet at no time have I ever allowed myself to speak disparagingly of plaster of Paris as an impression material, or about those operators who have consistently employed it in their work. I grant without equivocation that plaster of Paris as a material for dental impressions has lost none of its virtues, and I know full well that the manufacturers of dental plasters are continually striving to improve their formulas.

Modeling compound possesses all the necessary properties for taking good impressions of edentulous mouths; but these properties must be understood, and manipulation of the compound must be mastered to insure best results. From time to time, the statement is made that modeling compound is too difficult to handle; and also that modeling compound technic is too difficult to teach to the undergraduates.

In answer to the latter claim, I make the following statement: For the past eight years, all impressions of fully edentulous mouths in the undergraduate as well as the postgraduate clinics at Northwestern University Dental School have been taken with modeling com-

*Read before the Section on Full Dentures at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1930.

pound. The undergraduate student, with rare exception, is found proficient after he has completed three full upper and lower dentures, and proves his proficiency by doing his fourth case as one of his special senior requirements.

That a certain amount of manual dexterity must be developed goes without saying, but this is also very essential for the successful performance of many other dental operations, and its development should be encouraged whenever opportunities present.

It is now fitting to get to the particular subject matter of this paper, the distinct advantages of closed mouth muscular action in the development of modeling compound impressions for edentulous patients. We shall treat the maxillary and mandibular impressions separately.

PROCEDURE FOR MAXILLARY IMPRESSION

1. Preliminary upper and lower impressions are taken with stock form trays.

2. Study models are made of plaster of Paris.

3. Soft metal trays are selected, trimmed and conformed to the casts. These trays, having no handles, facilitate the closed mouth work. The inner surface of the upper tray is smeared with modeling compound in a fluid or highly adhesive state to afford firm attachments for the impression mass. The under side of the tray in the ridge area is similarly treated, and to this an occlusal rim is attached. The lower tray preparation consists of a 3 mm. layer, covering the denture area of the study cast. This is reinforced by a properly trimmed and shaped tray, which is sunk into the upper surface of this compound layer. Then a smear is applied to the exposed tray surface, and an occlusal rim is attached to this.[1]

1. Prothero, J. H.: Prosthetic Dentistry, Ed. 4, p. 521-541.

4. The test or final maxillary impression is made by attaching a sufficient amount of softened compound to the tray, forming it so as to facilitate the displacement of air, the proper placement of tissues and the correct flow of the mass during the taking of what is termed the base impression.

This consists of introducing and centering the tray, forcing it toward the tissue with a wavelike motion until all the air is displaced by the compound, then applying central pressure in an upward direction until resistance halts further upward progress. The tray is now supported by sufficient pressure to keep the material in contact with the tissues of the vault and lower portion of the ridge, and the flange material is molded upward and inward against the labial and buccal surface of the ridge, so as to be carried beyond the position of border muscular attachments. In this state, it is hardened by the injection of cold water, preferably ice water. The patient is asked to close the lips and inflate the cheeks, so as to dislodge the impression with the least possible distortion.

At this stage, the flanges are overextended. It is this overextension which furnishes the excess material against which the later muscle action is brought into play, to obtain, more or less automatically, a proper peripheral extension, as well as an adaptation that will insure covering the maximum surface area, with complete tolerance by the border as well as supporting tissues. An occlusion is next developed with the opposing rim as follows: The lower compound base is fitted to the ridge by softening its surface and pressing it gently down against the ridge. It is hardened by cooling, and tested to see that it may be firmly reseated on the ridge without discomfort to the patient.

The maxillary rim is now trimmed to approximately lip length, its occlusal surface flattened and v-shaped notches cut in the bicuspid region. The upper base impression is replaced and firmly seated, the occlusal surface of the lower rim is softened, the lower base placed in position and the patient is asked to close, forcing the softened lower rim against the upper, which should have been lubricated to permit easy separation. This occlusion need not register centric relation or correct bite opening, as it is but an occlusion for conveniently and securely holding the upper base firmly during the subsequent closed mouth muscular actions. It should be checked after the lateral surplus has been trimmed from the lower rim. If it is found that the closure of the rims displaces the upper base, the occlusion must be corrected by reheating and reclosing. Such errors result from lack of uniformity in the softened compound area, and will defeat the operator's intentions if not corrected.

There are but five steps in closed mouth action employed to mold the flanges to proper form. The first three are similar in action and results; namely, first, the upper, inner two thirds of the flange area from heel to the cuspid region, including the edge of flange, is heated by applying a small brush flame with a sweeping motion until the compound is softened to the depth of about 2 mm. The heated area is dipped in warm water to reduce surface temperature, the impression is carefully placed in position, the lower base is placed and the patient is instructed to close and suck, and to repeat this action several times, after which he is asked to keep the jaws firmly closed until, by injection of ice water, the treated area is hardened. The second step is like the first, on the opposite side of the mouth. The third treats the region between the cuspid areas. For the fourth and fifth steps, the outer surface is heated and the patient is asked to close the jaws firmly, and to keep them closed and move the lips forward and back, alternately, five or six times. This horizontal muscle pull eliminates any interfering flange extension that the vertical and downward muscle action of the suction trim failed to remove.

There is one muscle action used to finish the molding of the compound, but this is done with the mouth wide open. It is the frenum trim. The inner and outer compound surface in the region of the labial frenum is softened, the impression is placed and firmly seated and as the operator holds it in position, the patient is asked to draw the lips downward and back two or three times. The treated area is chilled and the impression is removed and inspected. The height of the impression flange is compared with the height of the ridge as judged by the position of the border attachments. If it appears properly proportioned, the impression is reseated and the patient is asked to try to dislodge it by muscular action. If it becomes dislodged, muscle trimming is repeated until the patient is unable to dislodge the impression.

To complete the impression, the relief areas are outlined and a postdam is applied.

To sum up the advantages of the closed mouth muscle trimming for upper impressions, I submit the following: By permitting the muscle to mold the softened flanges, perfect peripheral adaptation and extension are automatically assured. No overcompression of border attachments is possible, because this tissue tension not only molds the softened compound, but also is maintained until the compound is hardened, thus preventing a possible reexpansion. The open mouth

muscle action for the frenum trim assures freedom for this attachment, and because all these muscular actions are extreme, they insure full freedom for every future extreme or lesser action, and a further advantage had in the completed compound impression is the ability to check and test the retention.

Those who are familiar with the work of Russell W. Tench, of New York, will recognize that the technic referred to in the preceding paragraph is, with possible slight variations, the same as taught by him as many as ten or twelve years ago, and described in "Professional Denture Service" by Clapp and Tench.

The procedure for taking the mandibular impression, which is about to be described, is also based upon Tench's teaching, yet I have adopted greater variations for purposes of simplification. These modifications are more fully given by Prothero.[1]

### MANDIBULAR IMPRESSION

The mandibular tray preparation which has been used as an occlusal support during the closed mouth work done on the maxillary impression is now used as a quasidummy denture in what might justly be termed a rebasing or relining procedure in which this dummy serves as a tray, and it seems fitting here to give an outline of the steps of technic.

1. All peripheral overextensions are trimmed off the compound base.

2. The completed maxillary impression is properly seated in the mouth. It will furnish occlusal guidance to position the mandibular tray and help to maintain its position during the taking of the impression.

3. The inner surface of the mandibular base is seared by passing the brush flame over it. This facilitates the adhesion of the lining.

4. A lining of softened compound 2 or 3 mm. thick is applied to this surface and distributed more or less uniformly, except that the lingual flange is given a slight excess.

5. The impression surface of the lining is next brought to a high state of plasticity by the application of the brush flame with a sweeping motion, and the heated surface is tempered by dipping it in water at about 150 F.

6. The mandibular base with the attached lining is now placed in position, and the patient instructed to close, to suck and to swallow, and to repeat these actions three or four times, after which he is asked to keep the jaws firmly closed until the entire mass is chilled by the injection of ice water. Both impressions are now removed and placed in a bowl of ice water.

7. After the mandibular impression has become thoroughly hard, it is dried and carefully inspected so that the negative markings of the internal and external oblique lines, the labial and lingual muscle attachments anteriorly and the retromolar triangle areas posteriorly may be found. An outline is scribed on the impression surface, denoting the position of the above mentioned landmarks with a sharp knife, the overextension is trimmed away, so as to leave the periphery extending about 1 mm. beyond the outline, and the edge is so trimmed as to leave it about 3 mm. thick and slightly rounded.

8. The impression is now replaced and carefully seated on the ridge, then checked as follows: (a) Firm downward pressure is applied to see that the surface adaptation is such as to permit the application of pressure without discomfort to the patient, and to test the stability of the base.

(b) Tests are made to determine that the impression is not extended beyond tolerance limits.

(c) Tests for resistance toward displacement are made.

9. After the foregoing tests have been satisfactorily made, or corrections performed in the surface formation to assure them, the impression is completed by making slight tracing-stick additions about the distal termination of the retromolar triangle areas, as described by Prothero.[1]

These tests and corrections are made with what might be termed open mouth technic; while it should be noted that the mandibular base impression was developed as a part of the closed mouth technic.

If, after the latter corrections have been made, the impression is again tested, and it is found that it does not comply fully with the requirements for comfort, stability and resistance toward displacement, further corrections are carried out until the desired results are obtained. This might call for a second relining.

It was not the intention in this paper to present a complete text, but I felt it was necessary (because of its previous publication) to give at least a partial presentation of the procedure, so as to better portray what the advantages of the employment of the steps of closed mouth technic are.

To summarize these advantages for the taking of the mandibular impression, they are:

1. Perfect surface adaptation to the supporting tissues.

2. Correct placement of the supporting tissue as well as the adjacent border muscular and connective tissue attachments, insuring to them as far as the surface formation of the denture base is concerned with it, absolute comfort and freedom of movement.

3. Coupled with the open mouth corrections at the heel portion or posterior termination, the development of maximum resistance to displacement.

There are further advantages that those who have been consistent in their use of this, or a similar technic, have experienced, not the least of which is the actual saving of time.

It is true, also, that good impressions can be obtained of mouths in which are found severe undercuts, and where much loose movable and spongy or flabby tissue exist; this in spite of certain acceptable beliefs and published statements to the contrary.

May I offer, not an apology, though that might be in order for occupying your time with a presentation of an oft-discussed subject, but a suggestion that what we need is a greater desire to do better impression work, and less of the new fangled ideas and contraptions that are supposed to replace manual dexterity and cerebral activities.

# EXTRACTION OF TEETH; EMPHASIZING THE ADVANTAGES OF LOCAL ANESTHESIA IN DIFFICULT CASES*

By BOYD S. GARDNER, D.D.S., Rochester, Minn.

IN 1853, Willard[1] described in detail the operation which is now referred to as the open-view operation for removal of teeth, the surgical removal of teeth, and the surgical preparation of the mouth for dentures. In 1863, Colton, Allen, Hurd and Smith[2] announced to the profession that they were devoting time and attention to the preparation of the mouth for plates. In 1868, Shadoan[3] emphasized that a second operation is necessary in order to remove the sac that sometimes is attached to the apex of the tooth. Thus, we see that, at quite an early date, various dentists in the United States were thinking that simple extraction was not adequate for removal of a tooth and elimination of its associated lesions and that the alveolar process should be more or less reduced by surgical means, for artificial work. It is reasonable to believe that these ideas were laid aside and quite forgotten because for the next fifty years, approximately, dentistry went through an era of saving teeth, rather than extracting them. In recent years, these old ideas have been rejuvenated by several American and European dentists, and, by their efforts, the technic of the extracting of teeth, in general, has shown rapid improvement.

It is fairly well recognized that from 75 to 80 per cent of the revenue from dentistry is derived from replacement of lost teeth. It is the fixed and removable bridges with their abutments, the partial and full dentures, that make "bread and butter" for the dentist. Therefore, surgery is the foundation for the large part of dentistry.

By referring to the history of dentistry, especially with its relationship to medicine, one understands why surgical procedures on the mouth are not on the plane of general surgical procedures or even surgical procedures in other specialties. It is because dentistry at an early date became an entity rather than a part of medicine.

On a recent trip through Europe, I gathered, at first hand, interesting and I believe important information regarding the extraction of teeth. I found that there is a great deal of difference in the osseous tissue that supports the teeth of people of the different countries that I visited. For example, in comparing English with Finnish people, an amazing difference may be noted in this respect. For generations, the teeth, the jaws and the muscles of mastication of the English people have had little exercise because

*From the Section on Dental Surgery, The Mayo Clinic.

*Read before the Section on Oral Surgery and Radiography at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1930.

1. Willard, A. T.: Dent. News Letter, 6 (July) 1853.

2. Dent. Cosmos, 5:17 (Aug.) 1863.

3. Shadoan, W. H.: Alveolar Abscess, Dent. Reg., 22:418, 1868.

their food has been, and is, of such a consistency that it can be masticated with little effort. Moreover, it has been lacking in the necessary vitamin content. Irregularities of teeth are numerous, arches are narrow and there is marked loss of bone which supports teeth. One would expect, therefore, that such teeth could be extracted more easily than those of the people of Finland, whose deciduous teeth even show abrasion due to the consistency of the food. Irregularities are consistently absent, the jaws are squarer, arches are well developed and the supporting osseous tissue is heavier and denser.

I saw more extractions of teeth in Great Britain than in any other country, and the greater number of them were performed under general anesthesia. Possibly this anesthesia has been more popular there because of the ease with which teeth can be extracted. In the Scandinavian countries, dentists cannot legally use a general anesthetic; therefore, they are at home with all forms of local anesthetics, and I believe for this reason they have, generally speaking, developed a better technic.

One of the most significant factors in the extraction of teeth is the study of the resistance that must be overcome in relieving the socket of the tooth. In the teaching of this point, especially in undergraduate work, the student must be impressed with the necessity of a more careful study of the tooth which is about to be extracted. If it is found, on examination, that the tooth in question has had little, if any, work to do for many years, perhaps owing to early extraction of the opposing member, or if the patient has formed the habit of masticating on the opposite side, then such teeth, regardless of the osseous tissue which supports them, should be extracted with greater ease.

On the other hand, if the teeth have been subjected to a great deal of work, as in the mouth of the tobacco chewer, more difficult extraction must be expected. Only with the newer methods of extraction can one determine the anatomic variations of the process. The roentgen ray has its limitations in this respect, but it is without doubt the most significant factor in making a diagnosis, as it reveals the anatomic variations of the roots, the relation of one tooth to another and other important data. It fails to demonstrate the thickness and consistency of the process which the operator must overcome. We tend to overlook the fact that, when forceps are applied to the tooth and it is rocked back and forth, we are really making the root an additional instrument. This particular point has been stressed by Thew[4]. If a root has been subjected to sufficient force to enlarge its own socket, the result is trauma to the entire socket; whereas, in the difficult cases, if some of the resisting process is removed, the tooth is more likely to be removed in its entirety, without fracture and without undue trauma.

Perhaps the extraction of the lower first molar typifies this idea. If the buccal process is removed so that the bifurcation is exposed, it is readily seen that when forceps are applied and the tooth is delivered buccally, not only has a great deal of resistance been overcome but also the fulcrum is lowered, and therefore the power of the lever is increased. The chisel and mallet can be used advantageously from another standpoint. If extensive restoration of the crown has

4. Thew, Wilton: Self-Contained Elevator and Electric Mallet, Dent. Mag. & Oral Top., 46:1243-1253 (Dec.) 1929.

been made, or if there is marked caries, the tooth can be severed at a point below the bifurcation of the roots, and thus the unpleasantness of crushing the tooth with the forceps as well as the unpleasant result of distributing particles of teeth and filling materials over the field of operation may be eliminated. It is generally recognized that the aim in extracting teeth is to remove the tooth in its entirety with the associated lesion, to leave the best foundation possible for restorative work, and to minimize trauma.

Study of the extraction of teeth from a postoperative standpoint does not consist merely in the study of the extracted specimen, as it is far more important to consider carefully the condition of the remaining tissues. Cutting of the alveolar process, and the tooth itself, is also an important consideration. Revolving instruments have been compared with chisels, and the results obtained have been much better when the smaller chisels and a proper mallet are used.

From a teaching standpoint, reference should be made to the simple mechanical principles which are used by artisans. For example: A post 1 foot deep in the ground is pulled out with less exertion than one 3 feet in the ground, and the shorter the root to be extracted, the easier it is removed, provided force can be applied. This is contrary to the early theories of extraction, when it was taught that the root should be kept long so that forceps could be applied.

The space necessary to remove a lower impacted third molar can be made with a chisel and mallet with less risk to the remaining tissues than with revolving instruments. Not only can this be done more quickly, but space can again be created by the same instruments, by removing part of the tooth itself. This is best determined by roentgen rays.

Much credit is due to local anesthesia in developing the newer technic. This applies not only to the extraction of teeth and removal of associated lesions, but also to the definite preparation of the process to facilitate denture construction. By its use, the operator can visualize and successfully demonstrate every step in the procedure.

It would appear presumptuous on my part to refer here to needle technic for making the different injections or to review any part of Gray's Anatomy. However, the safety of block work in general is accentuated by the statistics at the Mayo Clinic. The Section on Dentistry in the clinic is in its twelfth year, and procain block anesthesia has been used for the greater number of patients operated on, without a fatality. Lundy,[5] of the Section on Anesthesia of the clinic, is of the opinion that we should give our patients more premedical care. He advises giving 3 grains of sodium iso-amyl-ethyl barbituric acid to potients, even though they are to leave the operating room or dental office soon after the extraction.

General anesthesia will always be used by dentists; however, its indication should not be determined by the patient's wish, but rather by the judgment of the operator, based on the physical condition of the patient and the difficulties that might be encountered in the operation itself.

Thorough asepsis in local anesthesia and the slow injection of correct solutions are significant in successful use of anesthetics. The confidence the operator instils in the patient is also significant. It is impossible to compare end-results of operations when reference is made only to the anesthetic. The patients of one opera-

5. Lundy, J. S.: Personal communication to the author.

tor may actually have less postoperative pain and discomfort from the use of a general anesthetic, and, for this reason, he prefers such an anesthetic. But are such results always checked from the standpoint of roentgen-ray examinations made as a routine and tabulations, made before and after, of the patient's physical condition? In further emphasis of this particular point, one operator may secure far better results after extraction of a third molar by the use of some kind of pack or wick, which, no doubt, is due to the fact that there has been an excessive amount of trauma, and perhaps asepsis has not been carefully carried through. Another operator, in removing the same tooth with minimal trauma and by cleaner work, will get a satisfactory result from the use of sutures and from maintaining a blood clot even to the extent of interruption of the blood supply and the stimulation of the flow of blood the second day.

When the time comes that dentists who extract teeth take more complete histories and tabulate the preoperative and postoperative data in more detail, especially with reference to trauma and asepsis, the profession in general will be benefited. Moreover, it will then be possible to standardize instrumentation and technic.

The roentgen-ray examination from the postoperative standpoint still continues to be the best means of studying regeneration of bone and, in general, postoperative results. By comparing these data month by month, year by year, we are able to determine why it is that, in some patients, bone regenerates very slowly or not at all, whereas, in others, regeneration is quite normal.

It seems that, in the work of the last few years in this particular line, there has been vast improvement from a general standpoint.

DISCUSSION

*Charles W. Freeman, Chicago, Ill.:* In discussing the extraction of teeth, at the present time, it is almost unnecessary to emphasize the advantages of local anesthesia, as the title of Dr. Gardner's paper suggests. The great majority of dentists appear to be firmly convinced that local anesthesia is definitely to be preferred to a general anesthetic in nearly all extractions, whether simple or difficult. The disadvantages of general anesthesia are more pronounced in the more difficult cases if handled in the dental office. It is my opinion that no difficult extractions should be attempted in the office under general anesthesia except by the most experienced operators and who are confident that a predetermined technic will be completely successful. Dr. Gardner states that general anesthesia will always be used by dentists. This may possibly be true, but I am inclined to believe that the next decade will see general anesthesia almost completely confined to hospitals, where it properly belongs. There are, of course, many cases in which a local anesthetic is contraindicated, but, in most of these cases, which are principally acute infections, either immediate operation is contraindicated or hospitalization would be clearly preferable. Possible exceptions to this would be the cases of children who require minor operations but who are difficult to manage in the chair with local anesthesia. A significant statement of Dr. Gardner's regarding the need of more complete histories and tabulations of the preoperative and postoperative data should receive serious attention. A tremendous number of valuable data could easily be accumulated in a short time by any small group of dentists who would record and tabulate local conditions before extraction, the anesthetic employed, the operative technic and the postoperative conditions. The tabulation and study of such information would be a valuable guide to the individual dentist, suggesting to him the points where his technic might be improved, and it would give the profession some actual facts on which to base further studies. Postoperative discomfort and delayed healing occurs too frequently after the extraction of teeth. The causes for these complications are: (1) interference with blood supply and chemical and traumatic injury from the injection, (2) infection, and (3) trauma of the

operation. In reducing these complications, much can be accomplished by careful technic in injection, and selection of the best available anesthetic drug. I believe that a careful analysis of postoperative results would show that some of the anesthetic solutions on the market are responsible for unnecessary postoperative disturbance. The investigations now being conducted at Northwestern University Dental School are bringing out some facts which are pertinent, and which may indicate a distinct step in the improvement of local anesthesia. In eliminating unnecessary operative trauma, much can be accomplished by the individual dentist for the comfort of the patient and his own peace of mind. I am not in complete agreement with Dr. Gardner as to the methods to be employed in reducing this trauma. The chisel and mallet certainly have their place and should be employed where indicated, but in cutting a tooth in sections, or in removing dense heavy bone, the element of shock from the mallet blow is considerable, and I believe the revolving drill will frequently accomplish the necessary task with less injury to the patient. On the other hand, a clean cut with a sharp chisel undoubtedly leaves the neatest bone wound, and this method is to be preferred where adequate access is available and where the bone is not so dense and thick as to require an unduly heavy mallet blow, with consequent discomfort and shock. While I am in thorough agreement with the employment of suitable surgical procedures where indicated, I must confess to a sincere belief that too much unnecessary surgery, I think we may call it meddlesome surgery, is employed in some offices. The use of the scalpel, the chisel or the drill in the removal of teeth should not be routine practice, but be employed only where definite indication for such surgical intervention exists.

*Stanley W. Clark, Chicago, Ill.:* The point that all clinical factors and anatomic variations should be carefully studied before operating is well taken. We should all obtain uniformly better results if roentgenograms were taken of every field wherein operation is contemplated. This practice is generally invoked in large clinics. It would appear reasonable to assume the attitude toward all condemned teeth that they are best removed by extraction forceps, as less injury is brought to the part by such a procedure. Dr. Gardner suggests that when study of the field reveals thick, dense, compact plates of cortical bone together with long and possibly irregular roots, better results may be obtained by relieving the bone around the roots sufficiently well to permit a less eventful extraction. Such a measure surely reduces the trauma and relieves both patient and operator of some concern. A bibeveled drill, in preference to a bur, is a satisfactory instrument to accomplish removal. The drill does not accumulate débris, cuts with more facility and generates but little heat. A small chisel and mallet might also be used instead. The drill is less hard on the nervous systems of certain types of individuals and, therefore, is used to better advantage in more cases. It is possible to work out a system for the extraction of teeth with forceps, drill, chisel and elevators. Such a technic has been developed over a long period of time in our clinics. The labiolingual rotary movement for upper anterior teeth, the strong, full buccal and less powerful lingual movement for the upper bicuspids and first and second molars, the buccal movement combined with a mesial twist on the upper third molars, all of this extracting involving but universal upper molar forceps (bayonet), bayonet bicuspid forceps and straight upper anterior forceps; the stronger labial and weaker lingual movement for lower incisors, using a lower root forceps, the buccolingual rotary movement for lower bicuspids with the same forceps, the buccolingual movement of the lower first and second molars employing the cow-horn forceps and, finally, removal of the third molar with the lower root forceps or preferably an appropriate elevator. The movements hurriedly mentioned here are developed in the hands of every individual so as to make possible the removal of each separate tooth in practically the same manner indicated for that member. There are, of course, many variations which must be noted, but, in a general way, it is quite possible to thus systematize and thus render easier the extraction of all teeth. Elevators are indispensable to an oral surgeon or an exodontist. One could not practice successfully without them. They become so useful in the hands of some especially skilled operators that their employment tends to exclude the use of forceps. This is not the case with the ordinary individual extracting teeth, and it seems that he will accomplish more by the use of forceps supplemented with elevators, drills, chisel, files, etc. Dr.

Gardner prefers chisels and mallet in reducing the process overlying impacted third molars. This practice is satisfactory where it can be employed to a conclusion, but there are certain types of cases in which there is such dense, thick bone on the buccal and distal aspects that the exclusive use of chisel and elevators become impracticable. Here, a revolving instrument, namely, a bibeveled drill, may be used to advantage. The use of both chisel and drill in this kind of work seems to make an excellent combination. Drs. Gilmer and Potts have always used this drill in conjunction with the chisel and continue to do so at this time. All of this work is done with more skill and satisfaction under local anesthesia employing the various injections in conduction anesthesia as indicated. A 2 per cent procain-epinephrin solution has in the past proved most satisfactory, but, at present, much of the work may be done with more satisfaction under a 2 per cent procain borate-epinephrin solution. This latter solution is at least as efficient as procain hydrochlorid and not more than one-half so toxic. The teeth and alveolar processes of the English people were observed by Dr. Freeman and me during two years' service with the Northwestern University Unit assigned for service overseas with the British Army. Our records covered more than 20,000 cases, most of which revealed a deplorable dental condition. The lesser degree of density of the process of these people is undoubtedly dietary in origin. The carious condition of the teeth, which is astounding, is probably influenced also by a universal lack of knowledge of the necessity for proper care of the teeth. The extraction of the tooth seems to be the usual solution of correcting caries. The French people manifested this tendency also though it seemed to be in a lesser degree. We had some contact with East Indians whose teeth and oral cavity, while lacking hygienic care almost entirely, were found to be in a fair state of preservation. The process of maxilla and mandible of these black troops was well developed, thick and strong. The Scotch showed the usual faulty hygiene, but also had dense, thick cortical bone, which made extracting teeth more of a problem than in the other nationals. Dr. Gardner has referred briefly to premedication of cases handled under local anesthesia. This reference opens an extremely interesting field of therapeutics, much of which has been developed quite recently. It is said that therapeutic doses of certain of the barbituric acid group of agents given in premedication have a strong tendency to lower the toxicity of local anesthetics. Whether this is true or not remains to be proved by proper research. It does seem that the administration of 10 grains of soluble barbital the previous night followed by 10 grains given a hour or more before operating relieves the patient of toxic symptoms. It also quiets the individual sufficiently to make the operating uneventful. The most nervous types or the psychic types, both of whom frequently respond badly to the use of local anesthetics, are rendered quite favorable for operating. This premedication also serves as a sufficient depressant for postmedication, as the patient will usually need nothing more in the way of a depressant for several hours, and often no more at all.

# THE EFFECT OF ROENTGEN RAYS ON THE DEVELOPING TEETH OF RATS*

By RICHARD A. SMITH, D.D.S., M.S.D., Chicago, Ill.

ALONG with the realization that roentgen rays are of great value from the diagnostic standpoint came the knowledge that these rays may have an injurious effect on the cell if given in large enough doses. A vast amount of research work has been carried on in the last decade to determine the effects on cells of various doses of these rays.

It has been shown that the untoward effects of irradiation are usually acute and in the form of either burns and epilation, as a result of excessive dosage, or of acute constitutional symptoms; namely, malaise, lassitude and loss of appetite. In some cases, more severe constitutional symptoms consisting of uncontrollable vomiting, excessive diarrhea with passage of blood, fever which may reach 104 F. and profound prostration are present. The latter symptoms develop only after massive doses.

Dr. Burrows[1] states that small doses stimulate molecular disintegration, which is the source of normal energy for life. Large doses cause the disintegration of the more important molecular constituents of the cell.

The greater portion of the research on roentgen rays has been accomplished by the biologists and the medical profession. The only investigations that have apparently been made directly on the effect of roentgen rays on the teeth are three studies by Dr. Leist of Vienna.[2] Two of these concern the effect of the roentgen rays on the development of the tooth tissues; the third concerns the effect of the rays on the eruption of teeth.

The possibility that roentgen rays had an effect on tooth structures was called to Dr. Leist's attention by the following case: A young man who worked in a roentgen-tube factory as a tester of tubes was daily exposed to great amounts of the rays. After six months, he had lost considerable weight, he complained of tiredness and lost great quantities of hair when combing it, a symptom which pointed toward roentgen-ray injury. He also had a great deal of trouble with his teeth. Previous to this, he could hardly remember having a toothache. He had perfect teeth. Suddenly, a swelling appeared in the region of the upper left lateral incisor with subsequent fistula formation. The patient had no symptoms of pulpitis previous to that. One by one, the other teeth began to abscess.

A vitality test showed that twelve apparently intact teeth were not suscep-

*From the Research Department of Northwestern University Dental School.

*Read before the Section on Oral Pathology at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1930.

1. Burrows, M. T.; Jorstad, L. H., and Ernst, E. C.: Proc. Soc. Exper. Biol. & Med., 24:311-312 (Jan.) 1927.

2. Leist, M.: Ztschr. f. Stomatol., 1925, p. 797; 1926, pp. 452-459; Deutsch. Monat. f. Zahnhlk., 1926, p. 1-12.

tible to a weak Faraday current, eleven did not give a reaction to a medium Faraday current and three gave no reaction at all. These findings were rather startling. The injury had occurred within a comparatively short time in a mouth apparently not susceptible to caries, in the form of multiple destruction of the pulp. This destruction had taken the form not of pulpitis but of a noninflammatory disintegration of the pulps. The necrotic pulp became infected later on, probably by way of the blood stream. Dr. Leist thought it probable that the roentgen rays had caused the death of the pulp. Roentgen-ray experts denied this, saying that if this really was a case of roentgen-ray burn, the patient should show some skin lesions or disturbance of the glandular elements of the mucous membrane, and the submaxillary and parotid glands. In the light of this case, Dr. Leist undertook the following investigation[3]:

Eight rats were exposed to the roentgen rays, which were directed against the frontal aspect of the head. The distance of the tube from the skin surface was 28 cm., the voltage 120 kilovolts and the current 3 milliamperes.

Leist's dosage was figured in Holzknecht units. Sixty seconds of exposure would be necessary to produce one Holzknecht unit with a regulation dental x-ray machine which has a spark gap of 3 inches and a current of 10 milliamperes with a target skin distance of 7 inches. The dosage was given as shown in Table 1.

All of Leist's rats showed the same histologic picture. The teeth of the animals exposed showed interrupted dentin formation and degeneration of the odontoblasts. The calcified layer of dentin was abnormally thin, nichelike depressions occurred on the pulp surfaces of the dentin and over the thin calcified dentin was disposed a rather heavy layer of dentinoid tissue; that is, uncalcified dentin. A row of very degenerated odontoblasts was associated with this uncalcified dentin. Between the layer of calcified dentin and dentinoid tissue, there sometimes occurred a row of degenerated odontoblasts which, in an almost uninterrupted line, separated the calcified and uncalcified tissue. The contour of the dentin

TABLE 1.—DOSAGE (HOLZKNECHT UNITS) IN LEIST'S EXPERIMENT

Group 1

| Rat | Dose of 15 H | |
|---|---|---|
| 1 | 1 | |
| 2 | 4 | April 26-June 7 |
| 3 | 4 | April 26-June 7 |
| 4 | 5 | April 26-June 14 |
| 5 | 6 | April 26-May 31 |

Group 2

| Rat | Exposures | |
|---|---|---|
| 6 | 8 | (5 doses 1.5 H, May 3-June 21; 3 doses 15 H) |
| 7 | 9 | (6 doses 1.5 H, May 3-June 27; 3 doses 15 H) |

Group 3

| Rat | Exposures | |
|---|---|---|
| 8 | 9 | (1.5 H, May 3-June 27) |

was very irregular in the region of the nichelike depressions. No abnormalities could be observed in the enamel. Where the exposures were of lesser strength, the signs of injury were much less.

Leist also found a disturbance as regards growth in length of the tooth. This was observed from the following details: The distance between the niches decreased toward the apex of the tooth in spite of the fact that the intervals of time between exposures remained the same.

It was interesting to note that the roentgen rays had a selective effect on

3. Footnote 2, first reference.

the odontoblasts among all the other dental tissues. Leist notes that this fact corresponds well with the statements of Ranzi and Salis, who say that roentgen rays have a more pronounced effect on the mesodermal tissues of the oral cavity to which the odontoblasts and pulp belong, than on the epithelial tissues.

It was shown by Leist that roentgen-ray irradiation inhibits the growth of the incisors of rats by injuring the odontoblastic layer.[4] This injury was only a temporary one when a dose of 15 H unfiltered rays was given, as within a week after the effect of the rays had been noted, the tooth resumed its growth even though the portion grown anew was somewhat smaller than what normal growth would have afforded. Nothing abnormal could be detected in the odontoblasts of the newly grown portion. Thus, the incisors of the rat seemed to be susceptible to the influence of the roentgen rays, but the influence was only a passing one.

From his dog experimentation, Dr. Leist concluded that roentgen-ray irradiation delayed the eruption of teeth and diminished the growth of the roots of the teeth and growth of the jaws. He also found that it caused a loss of the permanent teeth.

The results of Leist's work, which show that an injury may be produced in a tooth by roentgen-ray irradiation, present a problem of practical interest to the dentist. Roentgenograms of all of the teeth are often necessary in the practice of children's dentistry. This is always necessary before starting the treatment of a case of malocclusion. At the time that these roentgenograms are taken, a large percentage of the permanent teeth are in a formative stage. It is therefore important to know whether the amount of exposure experienced by a child in having a full mouth dental roentgen-ray examination has an injurious effect on these developing teeth.

Leist's work does not cast any certain light on this problem, for his individual exposures as well as his cumulated dosage are far too high to be comparable with the exposures necessary for full mouth or repeated roentgenograms. Therefore, it was thought highly desirable to undertake the problem of determining whether an injury could be produced in the developing tooth by a series of roentgen-ray exposures which would be equivalent in some ways to the individual exposures and a repetition of exposures that a child might be subjected to in securing dental films. Experimental work was therefore undertaken along this line.

Six rats of the same litter were used in carrying out this work. Five of them were exposed to the roentgen rays when but 6 days old. The other rat, which was not exposed, was used as a control. Rats were chosen because of their incisor teeth having persistent pulps, which assured a developing condition that might be altered by the rays. Young rats were used to make possible an examination of the root development of the molar teeth (not having persistent pulps) for the effect of the roentgen rays.

The rats were exposed to a series of irradiations that was thought to be equivalent to the individual exposures or repetitions of exposures to which a child might be subjected in securing dental roentgenograms. They were exposed to the rays over a period of three weeks. (Table 2.)

The roentgen-ray technic was planned and carried out in such a manner that the rats were exposed to the central portion

4. Footnote 2, third reference.

of the rays at each irradiation. Each rat was held in position so that the strong central rays were directed on the mouth, the teeth and the jaws receiving the maximum amount of the rays at each exposure. In consideration of the fact that the bone in the present investigation was that of very young rats, the penetration of the rays could not have been greatly interfered with.

Ten days after the last irradiation, the rats were killed with ether and prepared for sectioning. Zenker's solution was used as a fixing agent. From the heads, which were prepared and blocked in celloidin, serial sections were cut transversely. Hematoxylin and eosin were used for staining.

TABLE 2.—PERIODS OF EXPOSURE (AUTHOR'S EXPERIMENT)*

| Rat | Time (Seconds) | Times per Week |
|---|---|---|
| 2 | 5 | 3 |
| 3 | 5 | 6 |
| 4 | 10 | 6 |
| 5 | 20 | 3 |
| 6 | 20 | 6 |

*Target skin distance, 7 inches; milliamperage, 10; spark gap, 3 inches.

A careful study was made of all sections for defects in the formation of the tooth substance. The dentin and odontoblastic layer were studied particularly for niches and defects as described by Leist. The roots of the molar teeth as well as those of the incisor teeth were studied for such defects.

To ascertain whether or not there had been an effect on the thickness of the dentin, measurements were made of the lower incisor teeth of the control rat and the rat given the greatest amount of irradiation. The dentin on the enamel side and on the cemental side of twelve sections was measured micrometrically. To secure a point at which to make the measurements and have them at the same level for each rat, it was necessary to select a landmark. The point at which the first molar appeared in the sections was used for this purpose, and six sections on each side of it were measured.

Leist has shown that injuries to the teeth from roentgen rays manifest themselves in three ways: injury to the odontoblasts, shown by an interruption of the dentin formation, decrease in the length of the tooth and a diminishing of the thickness of the dentin.

A thorough study of transverse serial sections of the jaws and teeth of the rats in the present investigation revealed no structural defects. The odontoblastic layer and pulp were normal throughout. The dentin was well formed and regularly calcified. The photomicrographs (Figs. 1 and 2) of the control rat and the rat having had the greatest exposure clearly bear out the foregoing statement. Sections taken from the same level of the jaws and teeth of the control rat and of any of the irradiated rats resemble each other just as closely as do the photomicrographs shown.

Because the sections were cut transversely, it is not possible to determine whether or not there has been a disturbance as regards the growth in length of the tooth. It was possible to measure the thickness of the dentin of each rat and compare the amounts in the irradiated rats with those of the control rat. These measurements and ratios determined from them demonstrated that the roentgen rays had not caused a diminution in thickness of the dentin. The average thickness in millimeters of the lower incisor teeth of each rat showed only a slight percentage of variation. The variation in the dentin measurements was very irregular and seemed to have no cor-

respondence to the dosage. So small were these variations that they could not be taken to be the result of the exposure, for a slight error in the microscopic measurement or even shrinkage in the preparation of the sections might account for it. If any defects had been present, they would necessarily have shown in these sections, for they include serial cuts through every tooth from the tip of the incisor teeth to and including the last molar teeth.

The difference in the results of this investigation and that of Leist is due, no doubt, to the difference in dosage. (Table 3.) It was probably the large individual dosage rather than the cumulative dosage that was responsible for it. At four times during the administration of the roentgen rays, the cumulative amount of the rays was the same in Leist's rat that was least irradiated and in the rat given the greatest irradiation in this investigation. Leist reports a defect for each irradia-

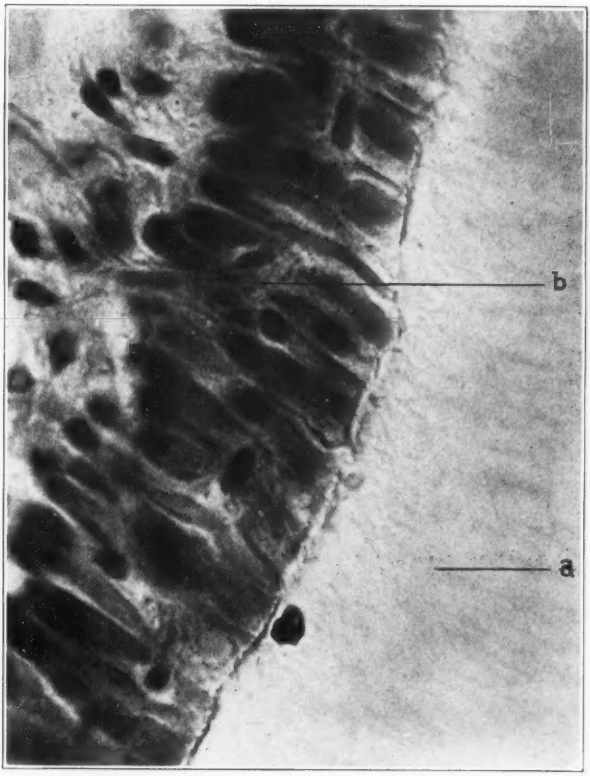



Fig. 1.—Section of tissue from normal (control) rat. *b*, odontoblasts; *a*, dentin.

tion, and although the dosage to which one rat in this investigation was subjected equals Leist's at four intervals in cumulative amount, no structural defects are discoverable. It is logical to assume, therefore, that the effect secured by Leist was probably caused by the individual dosage.

a theory concerning the effect of roentgen rays on the cell, the latter is susceptible to the rays only when in a mitotic stage. If this is true, the time element is an important factor in the effect of the roentgen rays, for the longer the exposure, the greater the number of dividing cells to be exposed. Leist probably regulated his roentgen rays so that the rats were irradiated for a longer time at each exposure than were the rats used in the present investigation.

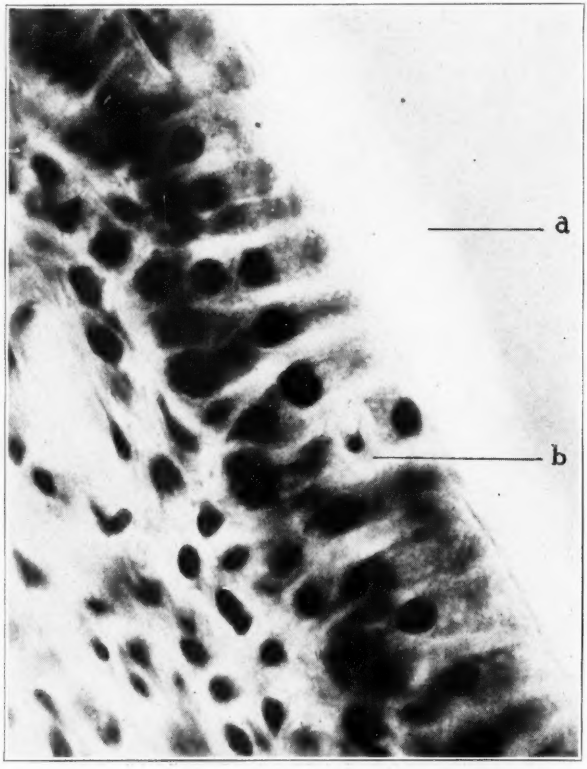



Fig. 2.—Section of tissue from irradiated rat. *b*, odontoblasts; *a*, dentin.

It is not possible to make a direct comparison of the dosage used in the two investigations, for all the circumstances of the roentgen-ray administration used by Leist are not reported. According to

It remains only to inquire whether

with dosages as small as those used in the present investigation, any effect on the teeth of rats should have been expected in the light of the experience of other investigators. Table 4 summarizes the literature on this matter, which I have had the opportunity to review.

With one possible exception, in none of these cases in which relatively small dosages were employed was any destructive effect produced, and in that one exception (Table 4, No. 2), the effect was on the second generation and not on the irradiated female mice. The trend of this evidence harmonizes with the conclusion that dosages as small as those used in the present investigation are not capable of producing destructive effects on the developing teeth of rats.

## CONCLUSIONS

1. Roentgen rays given in individual doses of 200 milliampere seconds and cumulative of 3,600 milliampere seconds did not cause defects in the dentin of any of the teeth of experimental rats.

2. These dosages caused no lessening of the thickness of the dentin of the lower incisor teeth on the enamel side or the cemental side.

3. These negative results may be said to be generally in harmony with the experience of investigators who have reported no injuries to other parts of the body with small dosages.

4. The difference between Leist's results and those of the present investigation are probably to be explained by the great difference either in individual or cumulative dosages employed.

TABLE 3.—VARIATIONS IN DOSAGE

Leist's Dosage

| Rat | Number of Doses | Individual H | Exposure Mil. Sec. | Interval Days | Total H | Exposure Mil. Sec. |
|---|---|---|---|---|---|---|
| 1 | 1 | 5 | 9,000 | .. | 5 | 9,000 |
| 2 | 4 | 5 | 9,000 | 10 | 20 | 36,000 |
| 3 | 4 | 5 | 9,000 | 10 | 20 | 36,000 |
| 4 | 5 | 5 | 9,000 | 10 | 25 | 45,000 |
| 5 | 6 | 5 | 9,000 | 6 | 30 | 54,000 |
| 6 | 8 | 5 @ 1½ | 5 @ 900 | 6 | 22½ | 31,500 |
| | | 3 @ 5 | 3 @ 9,000 | | | |
| 7 | 9 | 3 @ 5 | 3 @ 9,000 | 6 | 24 | 32,500 |
| | | 6 @ 1½ | 6 @ 900 | | | |
| 8 | 9 | 1½ | 900 | 6 | 13½ | 8,100 |

Author's Dosage

| Rat | Number of Doses | Individual H | Exposure Mil. Sec. | Interval Hours | Total H | Exposure Mil. Sec. |
|---|---|---|---|---|---|---|
| 1 | Control | .. | | | | |
| 2 | 9 | 1/12 | 50 | 48 | ¾ | 450 |
| 3 | 18 | 1/12 | 50 | 24 | 1½ | 900 |
| 4 | 18 | 1/6 | 100 | 24 | 3 | 1,800 |
| 5 | 9 | 1/3 | 200 | 48 | 3 | 1,800 |
| 6 | 18 | 1/3 | 200 | 24 | 6 | 3,600 |

TABLE 4.—SUMMARY OF THE LITERATURE

| Number of Subjects | Experimental Subject | Region Irradiated | Dosage as Compared with Author's | Injury | Investigator |
|---|---|---|---|---|---|
| 1 | Rabbit | Whole body | Greater | None | Nakabara[1] |
| 2 | Mice | Whole body | Less | No injury to animal exposed, descendants of second generation, of jaws | Johnson[2] |
| 3 | Rats | Abdomen | Much greater | Intoxication; diarrhea; death | Warren and Whipple[3] |
| 4 | Mice | Skin on back | Much greater | None | Cori[4] |
| 5 | Mice | Whole body | Less | None through sixth generation | Levine[5] |
| 6 | Fruit fly | Whole body | Greater | Effect on distribution of chromosomes during maturation | Mavor[6] |
| | Clinical Cases | Region Irradiated | Dosages Compared with Author's | Injury | Clinician |
| 1 | Woman | Right breast | Greater | None | Merritt, Groover and Christie[7] |
| 2 | Woman | Back | Greater | None | Erskine[8] |

1. Nakahara, W.: Studies on Changes in Lymphoid Organs After Small Doses of X-Ray, J. Exper. Med., 29:83-87 (Jan.) 1919.

2. Johnson, P. L.: Anatomical Study of Abnormal Jaws in Progeny of X-Rayed Mice, Am. J. Anat., 38:281-317 (Nov.) 1926.

3. Warren, S. L., and Whipple, G. H.: Roentgen-Ray Intoxication; Cumulative Effect or Summation of X-Ray Exposures Given at Varying Intervals, J. Exper. Med., 38:725-730 (Dec.) 1923.

4. Cori, G. T.: Effect of X-Ray on Skin of Vitally Stained White Mice; Establishment of X-Ray Unit for Skin of Mouse, J. Exper. Med., 39:639-643 (May) 1924.

5. Levine, M.: Influence of Roentgen Rays on White Mice and Their Progeny, Am. J. Roentgenol., 17:546-550 (May) 1927.

6. Mavor, J. W.: Biological Effects of X-Rays, Am. J. Roentgenol., 10:968-974 (Dec.) 1923.

7. Merritt, E. A.; Groover, T. A., and Christie, A. C.: Intrathoracic Changes Following Roentgen Treatment of Breast Carcinoma, Am. J. Roentgenol., 10:471-476 (June) 1923.

8. Erskine, A. W.: Minimum Erythema Dose with Diagnostic Voltages, Am. J. Roentgenol., 9:148-149 (March) 1922.

# INFLUENCE OF CHEMICAL REACTIONS AND BACTERIAL FLORA OF THE SMALL INTESTINE ON DENTAL PATHOLOGIC LESIONS*

By LLOYD ARNOLD, M.D., Chicago, Ill.

WE are accustomed to take the normal healthy individual more or less for granted and attempt to study intensively the sick person. Little attention has been given to the problem "Why is the so-called normal person healthy?" If we knew the conditions that were responsible for his perfect functioning physiologic machine, we would be better able to approach the problem as to why the sick person has an abnormal physiologic process. The structures in the oral cavity that are of interest to the dentist often undergo certain retrogressive or some degenerative changes that are secondary to systemic or metabolic alterations in physiologic function. I wish to present some of the results that we have obtained in our laboratories and indicate the relationship these original observations may have on some problems that are constantly confronting the dentist.

The first question I wish to discuss is, "What is a normal healthy person?" My conception is of an individual that has the proper coordination between the various physiologic functioning units of his body. The digestive tract, the urinary system, the respiratory apparatus, the skin, etc., are all interacting with each other in a harmonious manner. There is an equilibrium established as a result of many hundreds of years of development. This balance of physiologic activities of the organs that make up the individual is under the control of an involuntary or vegetative system.

The body is enclosed in some skin or mucous membrane covering layer. Sunlight acts in some way on the skin. The skin then transmits some kind of stimuli to the body as a whole. If a small area of the skin is exposed to ultraviolet light, the skin capillaries over the whole body surface are changed in their functional activity. This is brought about by the coordinating vegetative system. The ultraviolet light is a form, and can be used as an example of a skin stimulus. When the sensitive vasomotor tonus of the skin capillaries is changed by some external agent or stimulus, the capillaries of the alimentary tract, liver, pancreas and other digestive glands are also changed in their relative activity. Food entering the stomach stimulates the glands in the mucous membrane of this organ to secrete acid. The amount of secretion and the concentration of the acid depends on the character of food ingested. The food in this instance is the stimulus, the covering layer of the stom-

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ach is the site of stimulation. So long as we adapt ourselves to the stimuli that we receive from the outside world, we are healthy. This leads us to a consideration of adaptation to our environment.

We adapt ourselves to three major groups of environmental factors: climate, nutrition and parasites. The climatic factor is an important one. The human race has attained its highest development in the north temperate zone. Our climatic

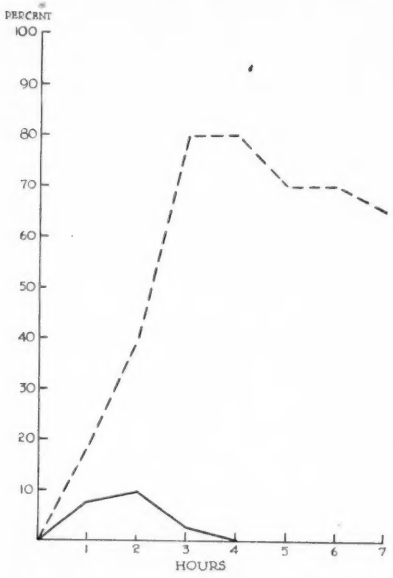


Fig. 1.—Percentage of B. prodigiosus appearing in the cecum after bacteria in suspension were placed in the stomach through a fistula; with time in hour intervals. The continuous line represents the relative concentration of B. prodigiosus in the cecum in rooms at ordinary temperature. The broken line represents the same in a warm and humid room. An average of twenty-five experiments, employing five animals, were made.

or meteorologic environment can probably best be considered from the dentist's standpoint by combining it with the nutritional environment. As the weather changes, we alter our diet. We unconsciously adapt our diet to body needs during the seasonal weather changes of the year. The lining mucosa of the alimentary tract is a body surface covering; the contents of this tube are therefore outside the body. Digestion takes place within the lumen of the gastro-intestinal tract, and the end products are absorbed into the body through the mucosa. This digesting and absorbing tube contains specialized glands that secrete ferments

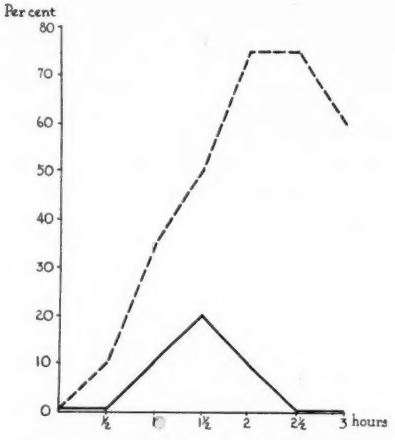


Fig. 2.—Percentage of B. prodigiosus appearing in the cecum after intraduodenal injection; with time in half-hour intervals. The continuous line represents the relative concentration of B. prodigiosus in a room at ordinary temperature. The broken line represents the same in a warm and humid room. Each graph represents an average of nine experiments. Three experiments were repeated, using three different dogs.

and other substances. These secretions poured into the lumen of the intestinal tract are as much outside the body as is the sweat secreted by the skin glands. The liver and pancreas are developed as

outgrowths from the primitive digestive tube. Many glands are located in the wall of this tract. Salivary, gastric, small and large intestinal glands are present.

The contents of this alimentary canal are mixed and moved in a regular manner. During the passage of food down the small intestine, it is mixed well with the various glandular secretions, and absorption rapidly takes place. Any substance that passes inside the membrane of the living epithelial cells of the intestinal mucosa is inside the body. From this standpoint, the intestinal tract is a specialized body surface covering. The contents are kept at body temperature. Ferments, acids, alkaline substances, fluids, etc., are poured into the lumen according to the character of the material within this tube. This material acts as a stimulus. The lining cells are the primary receiving stations and transmit the messages to the body as a whole. These messages are transmitted in many ways. Some go through nerve paths, some through the blood stream (hormone-like substances), and some of the absorbed molecules act as messengers to stimulate more remotely located organs. Avoiding a detailed technical discussion, we can consider the vegetative or involuntary coordinating mechanism that controls the digesting machinery as a part of our vegetative system. We automatically change the quality and quantity of fluids that we pour into the lumen of the gastro-intestinal tract according to the component parts of our diet. This is an involuntary process and is adjusted by means of our vegetative coordinating system.

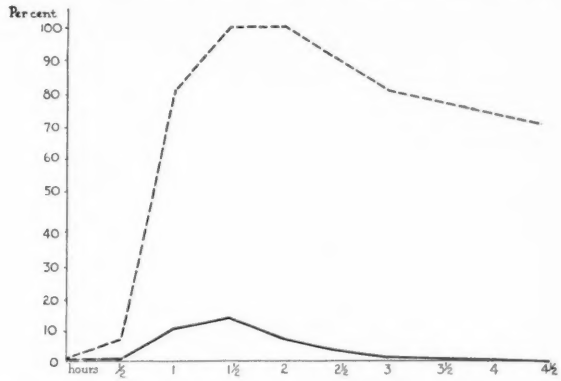


Fig. 3.—Relative percentage of B. prodigiosus present in the cecum, with time in half-hour intervals. The continuous line shows the concentration of bacteria (in per cent) after intraduodenal injection in saline suspension. The broken line shows the same after injection of bacteria suspended in dibasic sodium phosphate ($p_H$ 8-0).

Food acts as a stimulus to the mucosa of the stomach. The character of the stimulus and the corresponding response depend on the quality and quantity of the meal ingested. Protein foods cause a larger amount of acid to be secreted than either carbohydrate or fatty food. There must be a corresponding increase in the amount or concentration of the alkaline reacting secretions that are poured into the small intestine below the stomach.

The contents of the stomach are retained within this organ for a variable period of time, this depending again on the character of the meal. There is a continuous secretion of hydrochloric acid gastric juice until a free acid reaction is present in the material within the lumen of the stomach. Meat meals require a large amount of acid to saturate all of the available chemical combinations. The free acid present in the stomach during digestion is an indication that the contents have been completely saturated with acid. If the pylorus reacts normally, the contents will be emptied before an excess of free acid or masked acid is slowly replaced by alkaline reacting substances. Hence, the upper half of the small intestine contains no free acid and no free alkali, but a mixture of bound acid and alkaline compounds. There is normally a slight excess of the bound acid material, so the actual hydrogen-ion concentration of the contents of the upper half of the small intestine shows a predominance of acid reacting substances. This is expressed as $p_H$ 4.5 to 6.0, $p_H$ 7.0 indicating neutrality. When the lower half of the small intestine is reached, there is a different equilibrium established, the contents being

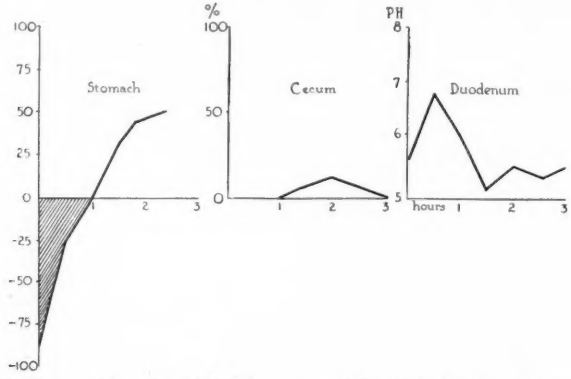


Fig. 4.—Left: Free acid and acid-deficit expressed in clinical units of material removed from gastric fistula. The ruled area shows the relative degree of acid-deficit. Plain milk, 300 c.c., plus B. prodigiosus, was fed. Center: Relative percentage of B. prodigiosus in material obtained from fistulous opening of the cecum. Right: The $p_H$ of aspirated contents of the duodenum. (Time in one hour periods.)

appears in the stomach.

The material entering the small intestine is not only acid in reaction, but what is of greater importance, it is saturated with acid. All of the buffer reacting substances are converted into acid salts. There is much more hidden or masked acid in this material than there is free acid. The free acid is quickly neutralized by the alkaline secretions of the pancreas, liver and intestinal wall. The combined neutral or slightly alkaline in reaction. More of the bound acid has been replaced by alkaline substances, or the former has been absorbed, which leaves a preponderance of alkaline reacting compounds.

The chemical reactions mentioned above are taking place outside the body. The process is an involuntary one. The adjustment of the acid-base equilibrium of the contents of the whole alimentary

canal is a function of the vegetative coordinating system of the body.

That portion of the lumen of the small intestine that is slightly acid in reaction contains very few bacteria. The bacteria that are present are acid-resisting cocci, probably belonging to the lactic acid producing cocci group. Other bacteria placed in the lumen of this segment of the small intestine are destroyed. The bacterial life ingested with fluids and food is not added or superimposed on the bacterial community residing in the lower part of the tulas, and the animals have been in the laboratory for a number of years, and have remained perfectly normal.

Figure 1 shows the results obtained when bacteria were placed in the stomach through the fistulas, and specimens were removed from the cecum at hourly intervals of time. It will be seen from an examination of this chart that animals in rooms of ordinary temperature show only about 10 per cent of the bacteria placed in the stomach to be viable in the cecum at the first and second hour after-

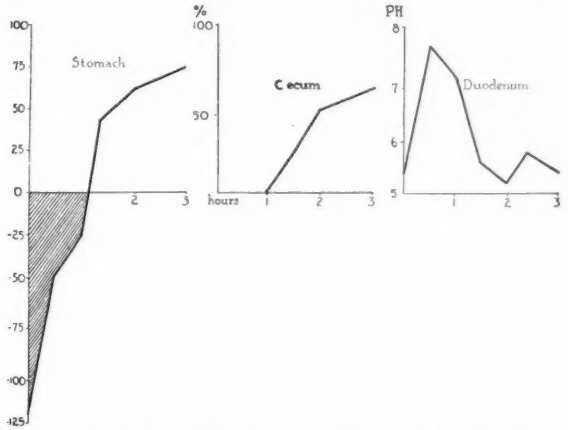


**Fig. 5.—Left: Free acid and acid-deficit expressed in clinical units of material removed from gastric fistula. The ruled area shows the relative degree of acid-deficit. Alkaline milk ($p_H$ 8.2), 300 c.c., plus B. prodigiosus, was fed. Center: Relative percentage of B. prodigiosus in material obtained from fistulous opening of the cecum. Right: The $p_H$ of aspirated contents of the duodenum. (Time in one hour periods.)**

alimentary tract, but these foreign strains are destroyed before they reach the lower part of the gastro-intestinal tract.

The experimental evidence that we wish to present has been obtained with the use of animals in our laboratory. Most of these animals were dogs that had been previously operated on in such a way as to create fistulas in the stomach and in the cecum. These were nonleaking fis-

wards. At the end of four hours, they have entirely disappeared. When these same animals are placed in a warm and humid chamber, the power of the intestinal tract to destroy bacteria is inhibited.

The bacteria placed in the stomach appear in the cecum in high concentration and persist for at least seven hours. This illustrates the effect of climate on the gastro-intestinal self-disinfecting power.

It might be said that this difference in the bacterial killing power was due to the stomach. We know that the stomach secretes less acid when the animal is placed in a warm and humid room. One might therefore say that the lack of acid in the stomach was the reason the bacteria were not destroyed.

Figure 2 represents an experiment that was made to determine the effect of the stomach in the bacterial killing power under the same condition as the previous experiment. The animals used for this group of experiments had the duodenum attached to the anterior abdominal wall in a previous aseptic operation. A non-leaking cecal fistula was also established. In this group of experiments, bacteria were injected in a saline solution directly into the lumen of the duodenum. It will be seen, from an examination of this chart, that the bacteria injected into the duodenum appeared in the cecum in large numbers when this experiment was performed in the hot room. We find, in other words, the same reaction no matter whether the bacteria were placed in the lumen of the stomach or in the lumen of the upper end of the small intestine. We are safe in concluding that the acidity of the stomach does not play a major rôle in the bacterial destroying power in these experiments.

Figure 3 represents the results of a group of experiments in which we used the same animals, except that in this instance, in addition to the saline solution, we injected an alkaline solution of sodium phosphate. It will be noted that the bacteria injected in the alkaline solution reached the cecum in the same concentration as they were placed in the duodenum. These animals were in rooms of ordinary temperature. This experiment illustrates the effect of the acid-base equilibrium of the lumen of the small intestine on the bacterial destroying power of this tract. When the contents are alkaline in reaction, bacteria are not destroyed.

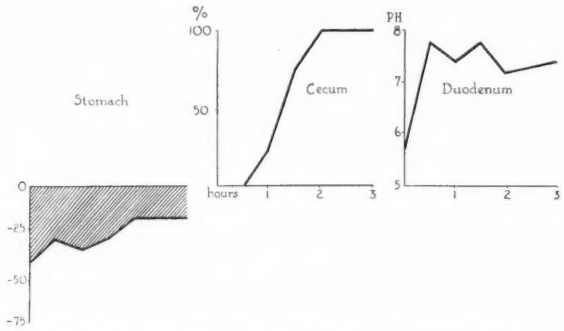


Fig. 6.—Left: Acid-deficit (no free acid present in this experiment). A 150 c.c. broth culture of the Shiga dysentery bacillus, lysed by bacteriophages, was fed. Center: Relative percentage of B. prodigiosus in material obtained from fistulous opening of the cecum. Right: The $p_H$ of the aspirated contents of the duodenum. (Time in one hour periods.)

Figures 4-6 show the results of a group of experiments in which we were trying to establish the relation between the acid-base content of the stomach and duodenum in relation to the destruction of bacteria in the small intestine by determining the concentration of bacteria fed

by mouth that appear in the cecum at definite time intervals. These animals had nonleaking gastric and cecal fistulas, and the duodenum was fixed to the anterior abdominal wall.

Figure 4 shows the results obtained when 300 c.c. of plain milk plus bacteria was fed by mouth. It required 85 c.c. of a one-tenth normal solution of hydrochloric acid to bring 100 c.c. of the milk to the point of free acidity. The ruled-in wedge on the chart shows the acid deficit, which in this instance lasted for one hour.

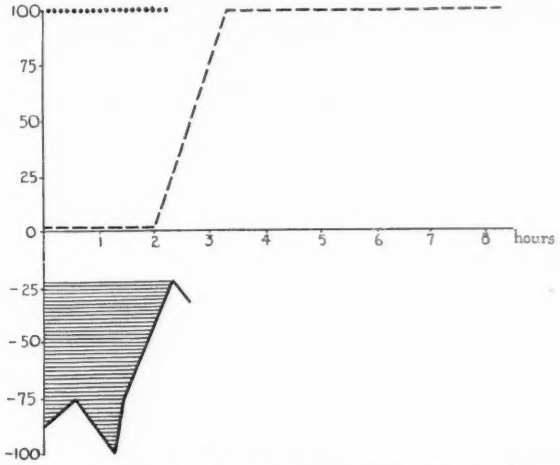


Fig. 7.—Results in experiments on dog with distemper. The rectal temperature was 105.5 F. There was a copious purulent discharge from nose. Plain milk, 300 c.c., and one agar slant of B. prodigiosus were fed. Below (0-100), acid-deficit in clinical units; above (100-0), percentage of B. prodigiosus in relation to ingested material. Dotted line, gastric contents; broken line, cecal contents. The continuous line with shaded area shows the acid-deficit of the gastric contents. (Time in hours after ingestion of the meal.)

At this time, free acid appeared. At two hours, there were a few bacteria appearing in the cecum. The lumen of the duodenum was entered with a needle attached to a syringe every thirty minutes for three hours. The material aspirated was used to determine the hydrogen-ion concentration. It will be seen that during the period when there was an acid deficit in the stomach, the contents of the duodenum became more alkaline, in other words, approached neutrality. When free acid appeared in the stomach, the contents of the duodenum became more acid, and remained so throughout the period of the experiment.

Figure 5 shows the results of some experiments carried out in the same manner. The difference between these and the previous experiments was that we added enough sodium hydroxid to the milk before feeding to increase the alkaline load in the stomach. The differences in the size of the ruled-in wedge illustrates the effects of alkaline milk feeding. It will be seen that more bacteria appeared in the cecum than in the previous experiment. The acid-base balance in the duodenum illustrates the change that takes place in this organ when the alkaline material from the stomach is emptied into

it. For a period of one hour, the contents of the duodenum is alkaline in reaction. At the time the free acid appears in the stomach, the contents of the duodenum return to the normal reaction. This illustrates the effect of an alkaline reaction in the upper part of the small intestine on the bacteria-killing power of this tract.

Figure 6 illustrates an experiment in which we placed 150 c.c. of dysentery bacilli proteins in the stomach. After considerable work, we found that this was the best material to bring about an

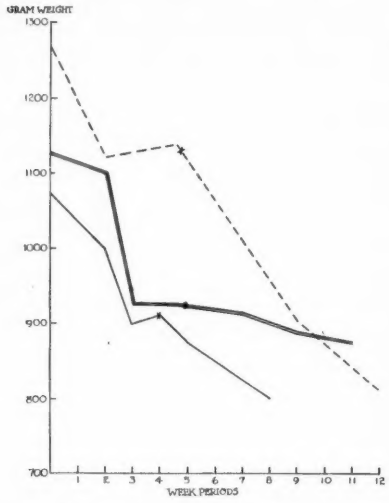


**Fig. 8.—Effects of B. coli endotoxins given to three different rabbits per os every three days for five weeks. Each line represents the weekly weight of one rabbit. *X*, time of appearance of diarrhea.**

inhibition of gastric secretion. This protein was irritating, and the stomach emptied itself without acidifying its contents. It will be seen that the stomach does not reduce the acid deficit to any extent. The bacteria appear in the cecum at the end of two hours in the same concentration as they were present in the stomach. Within thirty minutes, the duodenum becomes alkaline and remains so throughout the period of the experiment. These animals had diarrhea beginning two hours after feeding. The same bacteria were present in the fluid feces as were placed in the stomach. This illustrates the reaction that takes place within the gastrointestinal tract when irritating substances are ingested by mouth, as has been encountered in certain types of food poisoning.

Figure 7 shows the results of an experiment carried out on a dog suffering from distemper or snuffles. This occurred two weeks after we had opened a gastric and a cecal fistula in the animals. The rectal temperature was 105 F., and the animal was very sick. We placed 300 c.c. of plain milk in the stomach. Examination of the chart (Fig. 7) shows that there was an increase in the amount of alkali in the stomach after the placing of milk within the lumen of this organ. This must have been due to a regurgition of material from the small intestine into the stomach. The stomach emptied itself in two hours, and did not show free acid. In three hours, the bacteria appeared in the cecum in the concentration that was present in the stomach. This illustrates the reaction that takes place in a sick or febrile animal.

The presence of a heavy mixed bacterial flora in the upper part of the small intestine, such as occurs in most instances when the stomach loses its power to secrete acid, is not a normal location for such a microbic community. This part of the alimentary tract seems to be specialized for digestion and absorption. It is possible that in addition to the change in chemical reaction within this zone, which undoubtedly plays such an important rôle in calcium absorption, the presence of coli and similar fecal bacteria

within the lumen of this normally clean and almost sterile segment of the small intestine must be detrimental to the well-being of the host. Bacteria multiply rapidly and live for a relatively short period of time. The dead bacteria disintegrate and the protein contents of the microscopic cells become free and are in contact with the lining membrane of the small intestine. In the normal person, there would be a process of digestion in of the upper levels of the more alkaline-reacting parts of this tract. We have attempted to investigate some of the effects on the body of a gradual absorption of biproducts of *B. coli* that could take place under these conditions.

Broth cultures of *B. coli* incubated for twenty-four hours and passed through a bacterial filter to remove all of the micro-organisms have been found to contain a toxic substance that causes con-

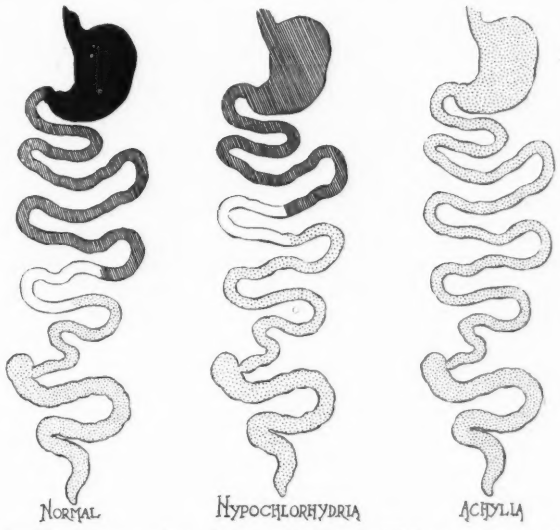


**Fig. 9.—Schematic representation of the acid-base equilibrium and bacterial flora of the gastro-intestinal tract based upon animal experiments. The normal, the hypofunctioning stomach and the condition of achylia are indicated.**

progress when protein material was present in the small intestine. But in the person with pyorrhea or other chronic septic oral pathologic lesions, there are degenerative changes in the glandular tissue in the wall of the stomach, and less acid is secreted. This contributes to the change in the material within the intestinal lumen and the feces types of bacteria ascend and become inhabitants vulsions and death when injected intravenously into rabbits. This has been termed an "exotoxin," as, during this short period of incubation, there are a relatively small proportion of *B. coli* destroyed and the toxic material can be considered as a byproduct of growth. When broth cultures are incubated for from two to three weeks, the condition is reversed, the bacterial free filtrate of this

old culture being composed of more dead and disintegrated cells than the young culture. The old culture filtrate was, for this reason, termed "endotoxins," indicating toxic material derived from the inside or an endogenous source. This toxin caused diarrhea when injected into rabbits.

These two toxins have different actions, one seeming to affect the nervous system, and one, the intestinal tract. Oral administrations of the "exotoxin-like" substances had no effect on rabbits. Oral administrations of the "endotoxin-like" substances caused chronic diarrhea, loss of weight and ultimately death in rabbits. Figure 8 shows the results of one of these experiments. The cross indicates the time diarrhea first developed. A chronic diarrhea was produced by giving small doses of this sterile material by stomach tube at regular intervals, as indicated on the chart (Fig. 8).

The same results can be produced by subcutaneous injections of very small doses. The large intestine is the seat of the pathologic process. A chronic colitis is produced. The subcutaneous or oral administration of the "endotoxin" substances of *B. coli* in proper doses causes the same reaction. The absorption of these substances from the upper end of the intestinal tract and elimination into the lower end can cause a chronic irritation at the place of excretion or in the colon. Dentists often encounter chronic colitis as a complication of certain chronic oral pathologic lesions. This experiment may aid us in understanding how some of these are brought about.

Figure 9 gives a composite representation of the acid-base balance and bacterial flora of the various segments of the gastro-intestinal tract. The stomach to the left represents the normal free-acid reaction in this organ. The upper part of the small intestine (ruled area) is slightly acid in reaction. There is a clear area representing the transition zone between the upper, slightly acid segment and the lower (stippled) alkaline reacting level. There are a few cocci-like bacteria in the upper level of the small intestine. This is the zone in which bacteria are destroyed. The lower alkaline reacting levels contain a varied and mixed type of bacterial flora. The transition (clear) zone contains a few more bacteria than the upper levels, but not such a concentrated microbic population as the lower segments. The changes in reaction of the various parts of the gastro-intestinal tract are indicated in the central schematic representations of a diminished amount of hydrochloric acid by the stomach. This varies with age, climate and diet. The third figure represents an alimentary tract in which the stomach has lost its power to secrete acid. It will be plain on inspection of Figure 9 that the alkaline reacting and heavy bacterial flora of the lower segment of the intestinal tract ascends cephalad as the gastric function becomes lessened.

The ratio between the acid and alkaline reacting substances within the lumen of the alimentary tract is an index of the physiologic status of the body. If an organism is in proper adjustment, as regards the acid-base equilibrium, the contents in contact with the mucosa of the upper half of the small intestine are slightly acid in reaction. This is automatically or involuntarily adjusted by secretion and absorption. The differences in the reaction between $p_H$ 5 and 6 (the normal) and $p_H$ 7 to 8 (the abnormal) in test tube experiments is so slight that little difference in the growth of bacteria can be determined. The intestinal secretions, pancreatic juice, bile and succus entericus, separately or combined, act as

good culture mediums for bacteria. The acid-base equilibrium of the contents of the upper part of the small intestine indicates the relative functional condition of the involuntary regulating machinery of the body.

The loss of the power of a body surface to destroy and regulate bacteria coming in contact with it is the first step leading to infection. Bacteria must penetrate an epithelial covering layer to get into the body and produce disease. The first line of defense is a layer of cells covering the body surface. This is not an immune reaction in the usual sense of this term. This self-disinfecting power is a normal function of a properly adjusted body. A healthy individual possesses this autosterilizing power.

The reaction of the contents of the upper half of the small intestine has another important bearing on dental problems. Calcium salts are absorbed in acid solutions. Alkaline compounds of calcium are not absorbable. When the whole of the small intestine is neutral or alkaline in reaction, the absorption of calcium would be markedly diminished, if not entirely inhibited. The calcium demands of the body would then be met by absorption from bone or tooth structures. The calcium salts are necessary for various cellular functions outside of their presence as supporting tissue elements in teeth and bones.

The question of pyorrhea occurring in that period of the life of man when he is most liable to experience a change in the gastro-intestinal tract that would interfere with calcium absorption offers food for thought. The gradual failure of the stomach to secrete acid after the fortieth year of life should be of significance to the dentist. Unless the diet is changed to meet the altered function of the alimentary tract, inorganic salt replacement would be interfered with by lack of absorption of certain necessary salts. The subject of caries will be dealt with later. The influence of diet and particularly the refined sugar component of the diet is receiving our attention. Certain intra-intestinal changes are being found that will add a new chapter to the problem of dental caries.

The body attempts to adapt itself to its surroundings. We have attempted to present our experimental evidence as to some of the reactions involved in this process of adaptation. The dentist must view the body as a whole in order to interpret properly what he sees in the oral cavity. In many instances, the oral lesions are indicators of systemic maladjustment to diet or to the presence of parasites. Some chronic diseases, such as tuberculosis and diabetes, and many other examples could be cited, are accompanied by certain retrogressive dental lesions. These are the result of errors in body adjustment. The causal condition, or the stimulus, is so long continued, or so intense or strong, that adaptation is impossible. The ability of the organism or host to adapt itself to the nutritional or bacterial environment is the determining factor in survival or ensuing death.

The influence of diet on the incidence of dental pathologic lesions is well known. One of the important factors in diet is the maintenance of the alimentary tract contents in a proper state of chemical and biologic equilibrium. The bacteria residing within the lumen of the intestinal tract are controlled and regulated by the lining mucosa if the individual is in a good state of health, the proper chemical medium being present for calcium salts to be absorbed.

SUMMARY

The chemical reactions and the bacterial flora within the lumen of the small intestine are regulated by the secretions of the digestive glands and by the condition of the mucous membrane lining this tract. The contents of the small intestine are an autoregulated wet dressing applied to the covering layer of the body surface. Alterations in the acid-base equilibrium can cause abnormal changes. The chemical reaction of the contents of the upper level of the alimentary tract has the added importance of influencing calcium and other inorganic salt absorption.

Health and disease have been considered from the standpoint of body adjustment to environment. The chemical reaction and the bacterial population within the lumen of the small intestine are excellent criteria of adjustment or maladjustment to our environment.

# FULL DENTURE DIAGNOSIS*

By CHARLES LANE, D.D.S., Detroit, Mich.

DIAGNOSIS for full denture service is one of the most interesting studies which are ours for consideration, and, as well as being of interest, it is a plain, everyday necessity. Our successes are due to diagnosis, or luck, and our failures to an incorrect diagnosis. As it is impossible to do justice to this subject in a paper of this length, it is my objective to call attention to a few items, in a superficial way, hoping to stimulate your desire for more of the subject and in greater detail.

The first item in diagnosis is, of course, the mental make-up of the patient, after he comes in contact with us. A successful merchant may be an unsatisfactory denture patient in your office and a satisfactory patient in the office of your contemporary. So it seems that we must be psychologists either by nature or by method.

We can have a wonderful measure of success by method, if we study the subject and apply our findings. Some failures will result at first, of course, but in time our applications are made in a nonchalant manner, when it becomes a success. When we start to drive an automobile, we almost have to stop the car to change gears, but in time we do the gear-shifting without thinking. We undoubtedly can do a more beneficial service in our practice by a knowledge of psychology.

The psychiatrist tells us that one-third of the population have evident mental twists; therefore, one-third of our practices are made up of these people, and if we cannot succeed it may be because we have the twist or that both patient and dentist have.

Successful practice, from an economic point of view, is dependent on three major items: psychology, engineering and technic. Of the three, it seems to me that from the point of view of income, the first is of most importance, because it has been noted that many dentists who can scarcely recognize a good piece of

*Read before the Illinois State Dental Society, May 16, 1930.

work when they see it have good active practices.

If we can add engineering to our accomplishments, we are better off. You have often interviewed patients who had had work done with which they were quite well satisfied, but which to you looked very unsatisfactory.

Now, if we can add technic to psychology and engineering, we will satisfy ourselves, our clients and our associates.

When a patient is consulting the dentist as to whether a tooth, or teeth, should be removed, the thought uppermost in his mind is esthetics. Even after a most exhaustive and earnest explanation in reference to the engineering items and the probable success or failure of dentures owing to the removal or retention of certain teeth, the patient still wishes to retain all that he can. It is with no difficulty that the point and objective of the patient is seen by the dentist, and he is very often willing to sacrifice or take chances with both the health of the patient and his own success.

It seems that we cannot expect to construct dentures successfully from the patient's point of view unless we have a foundation which can be considered of sufficient stability to maintain balance in the occlusion. The extremes that have come under my observation are illustrated in a case that in three months, could not even be rebased and retain facial dimension, and a case in which after sixteen years the change had been very little. These two cases were easy to handle because the condition was so definite; the insidious one is the trouble-maker, the one for which we seemingly cannot account and that continues to give trouble to the patient, which we charge to all manner of accounts. The foundation should be constant; i. e., any changes occurring should be in proportion in all ridge areas.

Fifty years ago, a toothache was sufficient reason for full mouth surgery and the application of dentures, which were worn with more comfort than the dentures of today. Of course, there was a deplorable loss of dimension and face form, but rarely do we see a loss of as much balance as was originally arranged for.

With the passing of time, denture work is becoming more and more demanding of skill, interpretation and patience, and the probabilities are that this demand will increase rather than decrease. Mouths are being given more attention, teeth are being treated, bridges and partial dentures are demanded to replace losses, pyorrhea is treated, etc. If these services are not carefully and intelligently administered by the profession, the result is badly broken down sections, infiltrated areas, knife-edge ridges, and almost always varying degrees of absorption of the alveolar process, making it almost impossible to maintain balance in full denture cases, and very often resulting in a decidedly uncomfortable condition.

You have no doubt noted that lectures and clinics on full and partial prosthesis are attended by increasing numbers in the last ten years, for the reason that the subject is demanding more intelligent interest. Almost every dentist has more difficulty with full dentures than with his other work, and many are thinking of discontinuing, or have discontinued, the art.

Most of us are aware that the more we know about denture service, the less we are sure that we know, and the result has been that we are not so eager to accept a case in practice as we used to be. Diagnosis reveals the necessity for

service, shows that the case will be a failure or gives assurance of success. To attempt a classification of the many conditions met with is almost hopeless. Some classifications have been developed which have assisted greatly, but they have but scratched the surface. Some of the conditions can be corrected, or partially so, and some cannot, but it is our duty to be sufficiently informed so that we can advise the patient.

One of the common cases is that in which the lower anterior teeth have been retained and the posterior areas have changed sufficiently that, at the time of the loss of the anterior teeth, there is a definite rise in the floor of the mouth. Or the posterior teeth on one side were lost eight years ago, on the other side, four years ago, and the anterior recently. It is possible to recite as many conditions as Dr. Cummer has developed combinations for partial dentures.

Now, we wish to place the full denture, and obviously the area where recent surgery was performed changes more rapidly than the other areas. There may be areas in either the upper or the lower jaw, or both, that are changing at different speeds, which results, of course, in the denture's being off balance. These differences may be more or less slight as far as the eye can determine, but sufficiently so to make the case inefficient, perhaps uncomfortable, and they are certainly evident in a gross way to the wearer. It is out of the question to rebase and renew cases in order to account for the changes, but you can feel assured that there will be no continued balance until in the different areas further changes occur simultaneously.

The reasons for surgery are very interesting to the full denture operator. It is well known that untreated pyorrheic teeth have an effect on the alveolus which is devastating to the extreme. The bony processes are left in a porous, infiltrated condition, repair very slowly and change form with great rapidity, thin sharp ridges, excess mucous tissues, infiltrated areas, absence of cortical layer and constant trouble to both the patient and operator resulting. In many cases the retention of these teeth is almost criminal, it being admitted, of course, that this is no fault of the dentist except in the case of lack of knowledge.

Each patient that comes to us for service is necessarily going to report and experience different degrees of success, or nonsuccess, and no doubt for as many different physical reasons, and only by diagnosis and understanding can we advise intelligently. Each case presents a different condition, and they are many. Take, for example, the different breadth of ridges and the different cheek, lip and tongue border tissue attachments to the ridges: some are high on the ridges and some are almost at the crest. It is no doubt a fact that broad ridges with high tissue attachments will do more work than thin ridges with crest attachments and the case presenting a variety of soft tissue depths; some cases being normal and others with areas of stimulated tissues due to ill-fitting dentures and trauma.

The breadth of ridges and the size of the stress-bearing area has much to do with the size of tooth selected and the kind of tooth, or rather what you do with the kind of tooth selected. It is unreasonable to expect a thin ridge to carry a broad masticating surface with as much efficiency as a correspondingly narrow tooth, having instead of deep interlocking facets freedom for movement with a chance for food escapements.

Face dimension has been much discussed in the past, and many rules have been suggested, but it is rather difficult

to restore the original dimension with comfort when the development of the presented condition may have been occurring for from ten to thirty years, or more. In fact, the dimension is being changed from the time the natural teeth start to wear; from the loss of one or two teeth to the loss of bridges, partial dentures, etc. When the time comes for full dentures and the patient and friends examine face detail, they, in many instances, see the loss of face length, which they had not previously been aware of. It is often hopeless to attempt a restoration, except by a series of dentures applied over a period of time dependent on the age and flexibility of the tissues. I have many times considered resorting to the artist's proportions, but the occasions when this can be done are rare. Also, it is rarely desirable to restore the original dimension when the case was undertaken. Therefore, the measurement of profiles is not of interest.

The thickness of the lips and their length and spread in movement is very interesting, because of the exposure of numbers of teeth, with possibly some of the base material. Shadings of teeth are different in proportion to their exposure and the light reflected. All other things being equal, the varying thickness of the lips makes sufficient difference to introduce, apparently, another shade. Also activity or inactivity of the lip makes a difference.

In the case of exposure of base material, carvings, providing for light reflection, almost hide the material as well as having an effect on the teeth shadings, bringing to mind that it is not the teeth or material, but what you do with the teeth and material, that makes the difference.

The opening of the mouth in movement is also very interesting. Mouths that appear comparatively small in repose sometimes have a surprising spread in smiling and laughter; or a large mouth may open or spread but little in movement. There are so many degrees to be considered that classification is almost hopeless, but consideration of these items is almost necessary for the satisfactory completion of a case.

In certain cases we have attempted to open the bite as much as three-quarters inch, and while the face dimension is perfect after lip elongation and the face tissues are properly arranged, the situation is almost hopeless from a comfort point of view, although it has been rather surprising how delighted some people are when they begin to appreciate what is being done. As an instance, we advised a patient that we did not wish to make the denture for the reason that we questioned whether she would submit to what would be necessary. She left the office, but curiosity got the better of her and she returned in a few days for further consultation. The third time that she came in, she advised us that she was ready for any program we suggested. We opened the bite fully half an inch, and, as you can imagine, she was uncomfortable, both physically and mentally, but she endured the discomfort for thirty days, and is now quite happy and feels that the effort was worth while. When the budget will permit, there is every reason for making a series of dentures.

On account of the loss of face dimension, the orbicularis oris muscle has contracted and all other tissues have shortened, and when the bite is opened, it is noticed that the teeth are excessively exposed, that the case does not appear well and there is discouragement in the air. Rarely do we find a patient content.

As these tissues elongate and develop activity and unconscious movement, the

esthetic result is entirely different. We must teach the patient to visualize this pleasing result, and if they believe that you are earnest and know what you are doing, they will cooperate gladly.

These cases are most cumbersome at first, and if Nature were not a wonderful compensator, it would be impossible to carry them to a satisfactory completion.

I have been referring to the extremes in my previous remarks, cases that require undivided attention. Our everyday case requires the same type of attention. If we have perfect, or nearly so, relations and an esthetic result when we present a case to a patient, it becomes less satisfactory as time goes on. In the first place, in twenty-four hours, it settles into the tissues and becomes too short, and as changes occur in the mouth, it becomes correspondingly less well fitted. As we do spot-finding and other balancing, it is still further off, and we should therefore visualize what we will have to do and plan to have a case which, at the end of thirty days, has the proper dimension. Further adjustments for dimension are accomplished by bringing the upper teeth down and the lower up. We can do much more for the appearance of our patient by opening the bite than we can by "plumping."

DISCUSSION

*V. P. Perisho, Streator, Ill.:* Dr. Lane called attention to the term "mental make-up." Take a little time to talk to the patient and study their mental characteristics. Compare them with other patients you have had to deal with. Study the lip, tongue and muscular movement. Do all this before telling them what they should have done. Dr. Lane also called attention to three major items: psychology, engineering and technic. These are three important factors. To leave out any one of them may mean failure. If any one's home should burn, the modern method today would be to consult an architect before rebuilding is started. But this architect would be a failure if he started to build the new home without first learning something about what kind of a home is desired. Our denture patients are without teeth at the time we start our construction. We should find out what kind of denture they have in mind, then study the case and advise them as to the best construction for their particular needs. It is very poor business to try to sell every patient the same class of work. My experience has led me to regard centric occlusion, and teaching the patient to recognize it, as being one of the most important factors in our successes or failures. We have all seen many patients who have formed the habit of chewing laterally or with the mandible protruded in order to strike some good teeth with which to masticate. This habit is sometimes caused by the loss of some of the permanent teeth. When the teeth are all extracted and we are scientific enough to establish centric occlusion for the patient, he will not feel right and will argue that this is not the natural bite. It is then that we need the power of persuasion to convince him that we are right, or convince ourselves that we are not. It is safe to say that most of the dentures in use today have never had the proper relations established with the two ridges. As regards the thin, narrow ridges, we see many hazards ahead for both patient and operator. As Dr. Lane has told you, the presence of abscesses and pyorrhea has so affected the ridges that we could not expect the first denture to be successful, but the patient does. It has been suggested that most of these cases show bone degeneration, and systemic treatment should be instituted to establish regeneration of the bone. These are just the kind of cases that we should especially diagnose, and in which we should have an understanding with the patient as to future service. Surgical extraction and proper ridge preparation is the first step. In recent years, we have not had a dental meeting of any importance without a paper or clinic on diet. A consideration of vitamins C and D seems to be the most important to the dentist or to his patients. Our research men now think that we can prevent most of these bone degenerative cases by balancing the diet and supplying the lacking vitamins. This subject should receive our serious consideration.

***Rupert E. Hall, Chicago, Ill.:*** There has not been sufficient attention given to diagnosis in denture construction. Many of our difficulties can be avoided, and many others can be lessened if we will take into consideration some of the things that Dr. Lane has told us. There is one point that Dr. Lane might have mentioned which may be of interest to us in connection with diagnosis. A woman from a distant western state came to me about four years ago, wearing a full upper and lower denture, with a statement that the lower was the third set that she had had made, and she was unable to wear them with any degree of comfort. Superficially, the case presented no particular evidence of any reason why she should not wear dentures with comfort, and I proceeded to construct a denture for her, thinking I would have no trouble, that all that was required was a painstaking technic. She remained in the city for some time, under observation, and returned after two or three days, with the statement that the lower denture cut her like a knife at certain times, that she was experiencing the same difficulty that she had always had. She pointed to the lingual aspect of the denture in the region of the synthesis, as indicating the place where it hurt her. The peripheral border of the denture was round in that region and there was not anything that could cut the tissue; nor was there any indication of any cut or any irritation, facts which I pointed out to her. It occurred to me if I would have a roentgenogram made, it might disclose something that we were unable to see. She did not think it was worth while, but I insisted, stating that I had done all I knew to do. In the region of the right bicuspids, there were embedded four pieces of amalgam, and one piece of the enamel of the crown of a tooth. The operation for their removal was a very minor one and it did not disturb the fit of the denture. The tissues healed in three or four days, and she was entirely comfortable. About a year ago, she returned to me for a new set of dentures, and reported that she had been perfectly comfortable. No doubt it would be good practice to examine by roentgen ray every denture case as a part of our diagnosis. People are not going to submit to this, nor are they going to appreciate it, until we, as dentists, point out the desirability of such procedure. We must first convince ourselves of the importance of the procedure, and then work in harmony as a profession in teaching our patients. There are many patients today that would not submit to having roentgenograms made in connection with dentures; and there are many dentists that would not ask them to, because they feel that the patient would not submit to such examination. We take the line of least resistance and proceed with the case. I do not believe we are justified in doing this. It occurs to me that there is the same occasion for such a diagnosis relative to denture work as there is in root canal work. Dr. Coolidge, I am sure, would not proceed to treat any devitalized tooth without roentgenograms, and more than that, a series of them as he works. I am glad to see denture work coming to the front, more interest being shown and more pains taken in the construction of dentures.

# ROOT RESECTION AFTER FOUR YEARS: REPORT OF A CASE*

By MYRON S. AISENBERG, D.D.S., Baltimore, Md.

COOLIDGE[1] describes a case of root resection after fourteen years, showing complete repair with cementum over the dead, denuded dentin, and a fibrous capsule over the root canal filling.

In the case now being reported, resection had been performed four years before.

Figure 1 shows four roentgenograms taken at various intervals after the resection, and in *4* (lower, right) the extent of bone regeneration is evident.

This tooth was extracted because the crown was accidentally fractured and the root was not considered a safe risk for a pin-crown restoration. The patient was in perfect health at the time of extraction, when a culture was made from the soft tissue found attached to the apical portion, and *streptococci* were isolated.

The root was then fixed, decalcified and sectioned.

Figure 2 shows a section lingually from the root canal filling, and at *X*, the cementum can be seen approaching from three sides.

Figure 3 shows the new deposit of cementum on the distal side. At *A* can be seen a layer of cementoblasts immediately over a layer of young uncalcified cementum. At *B*, newly formed peridental fibers can be seen embedded in the new cementum.

Figure 4, a higher magnification of Figure 3, shows, at *B*, the newly formed peridental fibers, torn, during sectioning, from the cementum. At *C*, new cementum can be seen being deposited in the presence of round-cell infiltration *(D)*.

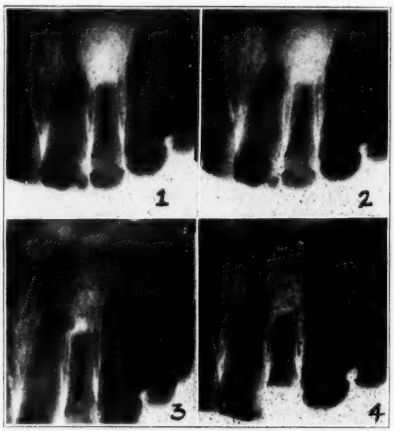


Fig. 1.—Roentgenograms taken over a period of four years.

Figure 5 shows the new deposit of cementum on the mesial side. At *A*, the dentin has been absorbed and repaired with cementum, and a new deposit of cementum toward the root canal is shown at *X*.

*Read before the Baltimore City Dental Society, April 14, 1930.

*From the Department of Oral Pathology of the Baltimore College of Dental Surgery, Dental School of the University of Maryland.

1. Coolidge, E. D.: Root Resection as a Cure for Chronic Periapical Infection: Histologic Report of a Case Showing Complete Repair, J.A.D.A., 17:239 (Feb.) 1930.

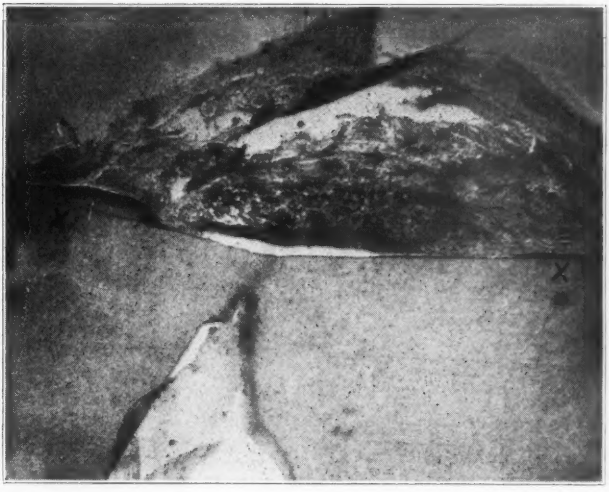


Fig. 2.—*X*, new cementum approaching root canal from three sides.

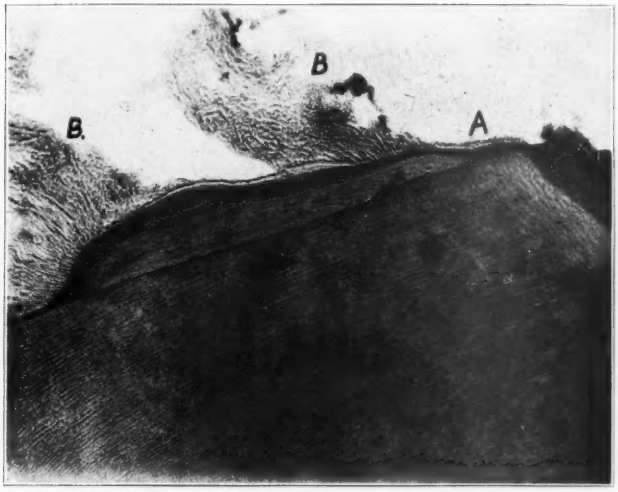


Fig. 3.—*A*, layer of cementoblasts over young, uncalcified cementum; *B*, newly formed peridental fibers.

Fig. 4.—*B*, newly formed peridental fibers; *C*, new cementum near area of round-cell infiltration *(D)*.

Fig. 5.—*A*, absorbed dentin repaired by cementum; *X*, new cementum over cut root end.

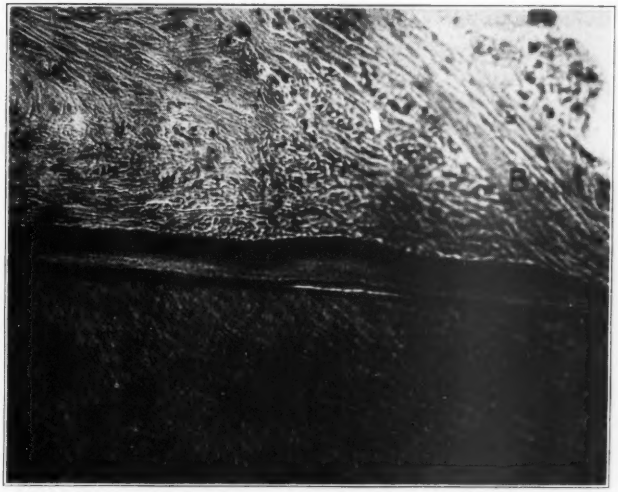


Fig. 6.—*B*, newly formed peridental fibers attached to new cementum.

Fig. 7.—Cementum torn during sectioning. At *E*, an organic attachment between the cementum and dentin is seen.

Figure 6, a higher magnification of Figure 5, shows, at *B*, the newly formed peridental fibers embedded in the new cementum.

Figure 7 shows the newly deposited cementum, torn, during sectioning, from the dentin. At *E*, an organic attachment is evident.

Figure 8 shows a section immediately over the root canal. The guttapercha was lost during staining. At *A* can be seen a band of fibrous connective tissue forming, evidently, to encapsulate the root canal filling. At *B*, the round-cell infiltration is evident.

This case is of unusual interest, because it shows that in this infected area, new cementum is being deposited. From the types of cells present in the area, and from the new cementum and the dense band of fibrous connective tissue, we conclude that if this root had been allowed to remain in the jaw for a longer period, complete repair, such as Coolidge describes in his case, would have occurred.

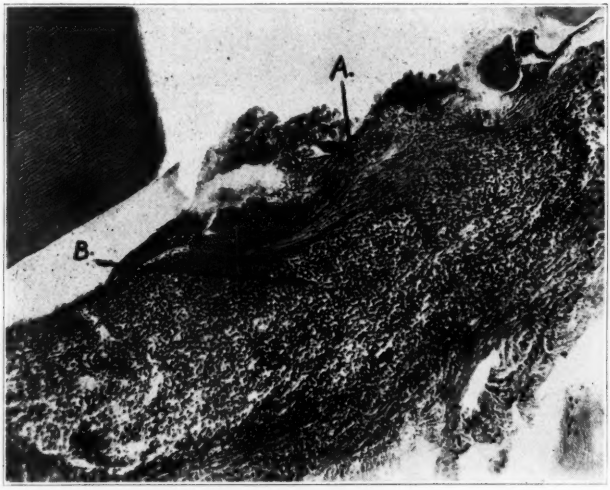


Fig. 8.—*A*, band of dense fibrous connective tissue; *B*, round-cell infiltration.

# The Journal of the American Dental Association

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## *Editorials*

### 1931

In every way, this should be an outstanding year. Not only in the professions, but in society at large, 1931 should register some very pronounced changes in the prospects and the point of view of our citizens. This is a professional publication not given to the discussion of civic or industrial matters, but there are very few of our nearly 40,000 readers who are not affected—many of them vitally so—by the present economic and social upheaval. And the question may well be asked—How many of them are doing anything to help the situation? As Mark Twain said of the weather: "Everybody is discussing it, but no one seems to be doing anything about it."

The question is continually arising as to the cause of all this economic maladjustment. There are probably various causes, but the one fundamental cause may be stated in the single word "over-

reaching." And the amazing thing is that some of our so-called economists are suggesting as a remedy still further overreaching. Excess inflation is never normal even in an automobile tire. One of the causes of overreaching — in fact the chief cause — is indulgence in too many luxuries on the part of those who cannot afford them. This generation has prided itself on the fact that the luxuries of the past have become the necessities of today; and in many respects, this is true. But the moment that the indulgence in luxuries outsteps the ability to pay for these luxuries, the economic structure is imperiled. When this happens with the individual, it places in jeopardy the financial stability of this individual. When it happens with many individuals in a community, it affects the entire community. When it happens in a nation, it affects the nation; and, to carry the consideration farther, nations are so intimately concerned one with the other today on account of increased transportation facilities that, to a certain degree, what affects one nation is likely to affect others. The chain seems interminable.

The unholy indulgence in unwarranted luxuries leads inevitably to speculation and the temptation to mortgage the future. Too much mortgaging of the future without the assured prospect of meeting obligations is not good economic practice. There may be some justification for going in debt in a legitimate investment, but never for the acquisition of luxuries. This is fundamental.

The present economic debacle in this country is due, for the most part, to the sheeplike tendency to follow the leader. When a few lambs are forced over the fence, the whole flock follows. Misery seems to love company, and the demoralization has spread till it has assumed altogether unwarranted proportions. There has been a lot of senseless whimpering which always seems to be contagious. Some very excellent people were caught in the stockmarket crash and were not able to meet their obligations. Instantly, hundreds and hundreds of people who had not been affected in the least, and whose incomes had not been reduced one iota, began hedging behind the excuse of the slump to delay payment of their

just debts. There is a very terrible psychology which seems to take possession of people at a time like this and which works havoc with their mental balance and even their fundamental honesty. It always tends to their demoralization.

There is, of course, much unemployment, which is always unfortunate; but there are other causes than lack of work. Here is a concrete case: A man conducting a small manufacturing concern needed another worker. He advertised and received very many applicants. When he offered eighty-five cents an hour, which he said was all he could pay on account of business conditions, he was met by the rejoinder that $1.50 per hour was the scale and they would work for no less. This winter the families of some of those men will probably apply for charity; and, by the same token, be it said to the honor and glory and the forgivable folly of the American people, they will receive it.

What this country needs in its present crisis is more sanity and less hysteria. Let us get back to fundamental honesty and pay our just debts without trying to hide behind every subterfuge to evade legitimate obligations. And let us work, every one of us, faithfully and loyally in a constructive way with the determination to give legitimate service for every dollar that we receive. In the recent past, there has been too great a tendency to try to get a living without working, and such a system never did work and never will. Let us have faith in the future. This country is not going on the rocks. It has as much material wealth as it ever had, and all we need to do is to change our mental attitude, look facts in the face, stop overreaching and senseless extravagance and go forward with supreme confidence that we shall save the situation, even if in so doing we must make some material sacrifices and forego certain of our foolish luxuries.

The time must come, and it now seems to be on the way, when we can look the world in the face and claim with all assurance that we have saved our economic soul. Let 1931 be the pivot to turn us from the shadows of the immediate past and anchor us firmly with our faces toward the light.

## THE EIGHTH INTERNATIONAL DENTAL CONGRESS

The eyes of the dental world will be turned on Paris, France, Aug. 3-8, 1931. On these dates, the Eighth International Dental Congress will convene for the purpose of demonstrating the most recent advances in our profession the world over. Our French colleagues are putting forth every effort to prepare a fitting setting for the meeting, and there is no city in the world better suited for such an event than Paris.

It is hoped that a full representation from America will attend. The Report of the Fédération Dentaire Internationale Committee of the American Dental Association to the House of Delegates at the Denver meeting in July, 1930, embodies the salient features of interest to the profession of this country, and we are accordingly publishing it on another page. We ask for this report a careful reading to the end that our members shall be well informed on this important event.

When we consider the very representative attendance from Europe at the Seventh Congress at Philadelphia in 1926, it must appeal to our sense of pride and equity to reciprocate in a loyal way by sending as large a delegation as possible to the Paris Congress. The United States is always given full representation in these international congresses, and it is only fitting that our members respond to the invitation of our French colleagues as expressed by the president of the congress, Dr. Georges Villain, in a message just received for publication. The message is as follows:

### GREETINGS TO THE MEMBERS OF THE AMERICAN DENTAL ASSOCIATION

On behalf of the committee appointed by the F. D. I. to organize the Eighth International Dental Congress in Paris, Aug. 3-8, 1931, we send our fraternal greetings to the members of the American Dental Association, and extend to every one of them a hearty invitation to join this great professional body.

The Congress, patronized by the president and the government of the French Republic, will take place in the Grand Palais des Champs Élysées of Paris.

The French Government will invite all other governments to send official delegates.

The scientific program will have the participation of the most eminent dentists in the world, and clinics will be given by the outstanding clinicians chosen by each national committee.

There will be an opportunity to meet the greatest men in the dental world, and to learn their methods.

The Organization Committee desire to leave in the hearts of every member attending a pleasant memory of the meeting and are accordingly providing all kinds of receptions and other festivities.

Provision will be made for the entertainment of the families of the members during the scientific meetings.

After the Congress, tours of various kinds through Europe will be arranged to suit the tastes of every one attending.

Our profession was the first to organize internationally, thus establishing a bond of fellowship throughout the world.

We beg our colleagues of the United States to come and help us with this Congress, and thus express in concrete form the sentiment of the late Charles Godon, one of the founders of the F. D. I., to the effect that "After all, humanity is above everything else."

Colleagues of America, Paris will welcome you heartily.

GEORGES VILLAIN.

The attractions of a trip to Paris at this season of the year are too well-known to need emphasis. Those who have visited Paris will require no urging to go again, while those who have not had this good fortune will surely want to avail themselves of the opportunity presented by the very advantageous rates and the unusual facilities for comfort provided by the transportation companies, who have given much study to the matter of itineraries. The prospect of congenial company with friends in the profession is an added inducement, and aside from the great value of the scientific and clinical programs and the inspiring intercourse with the brightest minds in dentistry, there is the alluring prospect of an ideal and inexpensive holiday.

In every way, the coming Congress offers an unusual opportunity for our members to visualize the latest and best in dentistry and at the same time to enjoy the benefits to be gained from an ocean voyage under the most favorable auspices. Let us show our loyalty to our French confrères by sending a fully representative delegation from the United States.

# COUNCIL ON DENTAL THERAPEUTICS

## PEARLO TOOTH POWDER—NOT ACCEPTABLE FOR ACCEPTED NONOFFICIAL DENTAL REMEDIES

PEARLO Tooth Powder was submitted to the Council by M. E. Schmidt, Columbus, Ohio. It is stated to be composed of magnesium peroxid, 60 per cent; perborate of soda, 30 per cent; castile powdered soap, 10 per cent, and a few drops of pure oil flavor. This powder was introduced into dentistry by Dr. Joseph Head many years ago. Powders of this composition have repeatedly appeared in dental journals and in textbooks on dental materia medica. The Council holds that the multiplication of names for established nonproprietary products is not in the interest of the dental profession and leads to confusion in therapeutic practice. The manufacturer of Pearlo Tooth Powder is therefore not entitled to the use of a proprietary name.

The Council accordingly declares Pearlo tooth powder inadmissible to Accepted Nonofficial Dental Remedies because a statement of composition does not appear on the label or on advertising matter; and because the manufacturer of Pearlo Tooth Powder is not entitled to a proprietary name for a well-established nonproprietary mixture. (Rule 8.)

## NASENE—NOT ACCEPTABLE FOR ACCEPTED NONOFFICIAL DENTAL REMEDIES

Nasene, according to the Clayton Laboratories, Washington, D. C., is a compound of sodium perborate, 15 pounds; menthol, 45 grains; thymol, 50 grains; methyl salicylate, 5 drams; oil of peppermint, 5 drams; oil of cassia, 1 dram; saccharin, 400 grains.

The principal label states it to be an alkaline compound with sodium perborate base. The directions include recommendations for its use as a mouth wash and gargle, as a dentifrice; after extractions, for canker sores and thrush, as a spray for nose and throat, in superficial scalds, for bathing feet and as a vaginal douche. On the whole, the recommendations for use by the laity do not seriously conflict with the provisions of the Council regarding direct advertising to the laity. Indications for its use in the treatment of trench mouth are unwarranted, as treatment and prescription for Vincent's infection should be entirely in the hands of the profession.

The statement of composition on the label, namely, "An Alkaline Compound with Sodium Perborate Base," is misleading in view of the declared statement of composition. Nasene is sodium perborate flavored with the agents mentioned in the statement of composition. No evidence has been presented to show its advantages

over sodium perborate N.F. *V.*, which is readily obtainable under a nonproprietary and noncompetitive name.

The Council holds that multiplication of trade names for official drugs or well established proprietary preparations is not in the interest of the dental profession and the public.

The Council declares Nasene inadmissible to Accepted Nonofficial Dental Remedies because the composition is not declared on the label or in the advertising; because the name is not indicative of the composition of the compound, and because the firm is not entitled to a proprietary name for a nonessential modification of an official drug. (Rule 8.)

## VACHER'S ANTIACID DENTIFRICE—NOT ACCEPTABLE FOR ACCEPTED NONOFFICIAL DENTAL REMEDIES

V. A. D. (Vacher's Antiacid Dentifrice) is claimed to be made from neutral soap of vegetable origin and to contain 20 per cent precipitated calcium carbonate and 5 per cent magnesium carbonate. It is sold in the form of a cake and is intended to be used both as a dentifrice and as a mouth wash.

The exact composition of V. A. D. has not been supplied, but as far as its qualitative composition is known, it does not contain any harmful ingredients and would come under the description of a dentifrice recently adopted by the Council (THE JOURNAL, 17:2130, 1930). No scientific evidence has been produced by the manufacturer to show its value over other dentifrices, but, on the other hand, there does not seem to be any valid dental objection to the use of such a preparation.

The question of its admission to Accepted Nonofficial Dental Remedies must rest largely upon the character of the claims made in advertising literature available. In this literature, much stress is laid on an alleged endorsement by officers of the United States Army Medical Corps. Letters on file in the office of the Secretary of the Council state that no such endorsement has ever been authorized.

Part of the advertising literature is supposedly based upon some work done a few years ago by Col. M. A. Reasoner of the United States Army Medical Corps (*J. A. M. A.*, 88:716, 1927). Another reference indirectly used is that to the work of J. E. Walker (*J. Infect. Dis.*, 35:557, 1924; 37:181, 1925). Colonel Reasoner's article concerns the treatment and prophylaxis of Vincent's infection by the use of soaps. While the quotations selected for the advertising of V. A. D. are correct, the impression obtained is not that which the author of the article intended to give. Briefly, Colonel Reasoner's conclusions are that ordinary toilet soaps have a spirochetal activity, but that "the proper use of soap and soap compounds is rather that of a prophylactic than a method of cure and their use for the latter purpose is not recommended."

The circulars advertising V. A. D. contain many statements concerning the ability of the preparation to destroy bacteria. The following quotation is typical: "Because it is antiacid and a wonderful germicide destroying Bacillus Acidophilus, that causes decayed teeth, as well as the other germs that sometimes infect the mouth."

No experimental data on such action are presented from the manufacturer. The stressing of claims for dentifrices as germicidal is definitely opposed to the policy of the Council.

Claims concerning the neutralization of mouth acidity are also made. Again, this is contrary to the policy of the Council.

The Council declares V. A. D. inadmissible to Accepted Nonofficial Dental Remedies because an exact statement of the chemical composition has not been furnished (Rule 1); the therapeutic claims made are unwarranted (Rule 6); and the name of the dentifrice, "Antiacid," implies a property of the ingredients which is of no apparent value in its use as a dentifrice, and therefore there is conflict with the provisions of the Council regarding the acceptance of dentifrices.

## NEW MIX DENTAL CREAM—NOT ACCEPTABLE FOR ACCEPTED NONOFFICIAL DENTAL REMEDIES

New Mix Dental Cream was presented to the Council by the Gilmont Products Company of New York.

New Mix Dental Cream is claimed to be a new departure in the dentifrice field in that it combines the supposedly good qualities of acid and alkaline dentifrices in one tube by means of a double tube.

The composition of the acid portion of the tooth paste (inner tube) is stated to be: glycerite of starch, 90.38 per cent; citric acid, 2.62 per cent; tartaric acid, 1.0 per cent; flavoring matter and cochineal for red color. The white paste, or alkaline, portion (outer tube) is stated to contain: glycerite of starch, 38.7 per cent; precipitated calcium carbonate, 31.5 per cent; glycerin, 3.8 per cent; and flavoring. The firm presented the article as a ". . . correct cleansing agent for the removal of deposits on the teeth, gums and oral tissues," and stated that "no therapeutic indications are given for the product."

According to advertising, New Mix Dental Cream is an attempt to compound in a dentifrice the various classes of products held by different people to be desirable as dentifrices, such as dentifrices of acid reaction; dentifrices of alkaline reaction and dentifrices containing antiseptic or mild astringent properties. This, the Gilmont Products Company claims, has been achieved by the patented double tube of New Mix and the composition. It is claimed that, because of this double tube arrangement, the acid part of the paste could curdle the mucin deposit on the teeth and gums, and that the alkaline portion can subsequently neutralize the acid portion. Gilmont Products Company do not make clear just why the excess acid should be neutralized, when they ascribe to it the power of curdling mucin.

No evidence beyond advertising statements was presented to show the advantages of keeping the acid and alkaline portions separate, or the advantages of such an arrangement over ordinary single compartment tubes containing a toothpaste of simple composition, or one containing sodium citrate or tartrate. It is reasonable to suppose that the acids in the inner tube are neutralized very shortly after mixing, with the net result that a toothpaste containing the sodium salts of these acids is

being used on the teeth. Whether a toothpaste of such composition possesses special virtues in the mechanical cleansing of teeth remains to be demonstrated.

Adequate evidence was not presented by the manufacturer to support the claim of the desirability of or the efficiency of New Mix Dental Cream to remove "mucinous plaques" although advertising matter states: "Actual tests show a curdling effect of approximately twenty seconds' duration during the brushing process and coincident neutralization by the alkaline constituent." In support of this claim is cited an experiment in which New Mix Dental Cream was brushed on false teeth in the presence of bromo-thymol blue and only after twenty seconds was "absolute neutrality" reached. This can hardly be accepted as evidence that New Mix curdles "mucinous plaques."

The advertising distinctly implies that New Mix is the ideal dental cream "which will help people to have firmer and more healthy teeth." How New Mix will do this is not apparent, nor is evidence offered in support of the claim.

The Council declares New Mix Dental Cream inadmissible to Accepted Nonofficial Dental Remedies because it is a dentifrice marketed with claims which conflict with the provisions of the Council regarding the inclusion of dentifrices to the list; and because adequate evidence was not presented to show the usefulness of the double tube arrangement which is featured in New Mix advertising. The Council desires to point out that claims in dentifrice advertising should be limited to their only apparent effect, that is, they are merely aids in the mechanical cleansing of the teeth.

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## ACCEPTED NONOFFICIAL DENTAL REMEDIES

**The following articles have been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association for inclusion in the list of Accepted Nonofficial Dental Remedies. A copy of the rules which govern the Council in the consideration of articles will be sent on request.**

SAMUEL M. GORDON, *Secretary.*

**BROMETONE.** — Tribromtertiarybutylalcohol. — Acetone-bromoform.—$CBr_3.C(OH)(CH_3)$. $CH_3$—1, 1, 1-tribrom-2-methyl-propan-2-ol produced by the reaction of acetone on bromoform.

**Action and Uses.**—Brometone is claimed to have the sedative action of the bromids without the disadvantage of producing bromism. In doses of 0.3 gm. (5 grains), four or five times a day, in adults, it is claimed that brometone causes no unpleasant results, produces no disturbance of the digestive organs and has no appreciable effect on the secretions. Its action is said to be prompt and its effect manifest for several hours. In doses exceeding 1.6 gm. (25 grains) daily, it may produce dizziness, vertigo or anorexia, but such symptoms disappear on the discontinuance of its use. Therapeutically, brometone is claimed to be useful in mild cases of excitation and insomnia, and to be indicated in dentistry, chiefly in nervous disturbances following extraction or other painful dental manipulation.

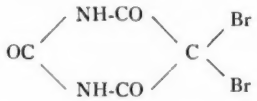
**Dosage.**—The dose is 0.3 gm. (5 grains), to be repeated two or three times during twenty-four hours.

Manufactured by Parke, Davis & Company, Detroit, Mich. U. S. trademark.

*Brometone Capsules: 5 grains.*

Brometone occurs in fine, white prismatic crystals which possess a camphoraceous odor and taste. It is slightly soluble in water, soluble in alcohol, ether, benzin and most organic solvents. It melts at about 167 C. and volatilizes on exposure to air.

**DIBROMIN.**—Dibromobarbituric Acid. — Dibromomalonylureide.




**Actions and Uses.**—Dibromin is an antiseptic and germicide proposed for use in solution as an irrigating fluid, for wet dressings and for flushing cavities. It is claimed that dibromin has a relatively high phenol coefficient and is practically free from irritating or toxic properties in the concentrations required for therapeutic use.

**Dosage.**—Dibromin is commonly used in solutions from 1:10,000 to 1:2,500, the weaker solution being sufficient for most purposes.

Manufactured by Parke, Davis & Company, Detroit, Mich. U. S. Patent applied for. U. S. trademark 158,277.

*Dibromin Capsules, 6 grains.*

Dibromin occurs as a crystalline, colorless powder; almost odorless; taste slightly astringent. It melts with decomposition at about 150 C. One part of dibromin dissolves in about 33 parts of water; soluble in ether, glycerin and alcohol; insoluble in fixed oils. The dry salt is permanent, but aqueous solutions decompose slowly. It is decomposed by alkalis, reducing agents and most organic substances.

Heat about 0.25 gm, of dibromin to 160 C.; bromin is evolved. Heat about 0.25 gm. dibromin with an aqueous solution of sodium carbonate: the odor of bromoform develops.

Dissolve about 0.1 gm. of dibromin accurately weighed, in about 20 c.c. of water, add 20 c.c. potassium iodid solution and an excess of diluted sulphuric acid. After one minute determine the liberated iodin by titration with tenth normal sodium thiosulphate. Iodin liberated corresponds to not less than 54.8 per cent of bromin. This corresponds to not less than 98 per cent of dibromobarbituric acid.

**APOTHESINE.**—γ-diethylaminopropyl cinnamate hydrochlorid. $(C_2H_5)_2N.CH_2CH_2CH_2COO.CH:CH.C_6H_5.HCl$. The hydrochlorid of a condensation product prepared by the action of cinnamoyl chlorid on γ-diethylaminopropyalcohol.

**Action and Uses.**—Apothesine is a local anesthetic of the procain rather than the cocain type; that is, it belongs to that type which, while effective for injection anesthesia (especially when combined with epinephrin), is relatively inefficient when applied to mucous membranes. It is rather slower in action than procain. Its absolute toxicity is less than that of cocain (as 20 is to 15), but about twice that of procain (as 20 is to 40). It is efficient and generally safe for injection. When injected, somewhat stronger solutions are required than are necessary with procain, or especially with cocain, but with adequate concentrations the anesthesia is just as complete. It is employed for infiltration injection, nerve blocking, intraspinal injection and pressure anesthesia. Apothesine solutions are not injured by boiling.

**Dosage.—As a local anesthetic, from a 0.5 to a 2 per cent solution, generally with epinephrin, in sterile water or physiologic solution of sodium chlorid.**

Manufactured by Parke, Davis and Company, Detroit, Mich. U. S. patents 1,193,634; 1,193,649; 1,193,650 and 1,193,651 (Aug. 8, 1916; expires 1933).

*Apothesine Solution:* Each 100 c.c. contains 1.5 gm. of apothesine and 0.5 gm. of chloretone (the latter is used as a preservative).

*Apothesine Hypodermic Tablets:* 0.08 gm. (1¼ grains).

*Apothesine and Adrenalin Hypodermic Tablets:* Each tablet contains apothesine 0.04 gm. (3/5 grain) and adrenalin 0.00004 gm. (1/1,600 grain).

*Apothesine and Adrenalin Hypodermic Tablets (B "B"):* Each tablet contains apothesine 0.3 gm. (5 grains) and adrenalin 0.0003 gm. (1/200 grain).

*Apothesine and Adrenalin Hypodermic Tablets Cylindrical (for pressure anesthesia):* Each tablet contains apothesine 0.01 gm. (1/6 grain) and adrenalin 0.000025 gm. (1/2,500 grain).

Apothesine occurs in white masses which are composed of small white crystals; practically odorless; faintly bitter, but producing a sense of numbness of the tongue; permanent in the air. It is soluble in water and alcohol; slightly soluble in acetone or ether. Its aqueous solution is neutral to litmus paper. The solution is stable. Aqueous solutions of apothesine produce precipitates with the alkaline hydroxids and their carbonates (the precipitate formed with sodium bicarbonate is soluble in an excess of the reagent), and with the usual alkaloidal reagents. The free base of apothesine occurs as an oil; when heated with strong sodium hydroxid, it is decomposed to diethylaminopropylalcohol and sodium cinnamate.

Apothesine melts at 136 C.

An aqueous solution of apothesine gives, with silver nitrate solution, a white precipitate which is insoluble in nitric acid.

Dissolve about 0.1 gm. of apothesine in 5 c.c. of water, add 2 drops of diluted hydrochloric acid and 2 drops of sodium nitrite solution (10 per cent) and mix with a solution of 0.2 gm. of betanaphthol in 10 c.c. of sodium hydroxid solution (10 per cent). A white precipitate is formed (distinction from ethyl animobenzoate, which gives a cherry red color in a solution containing undissolved benzocain and from procain hydrochloride, which gives a scarlet precipitate).

Add a few drops of gold chlorid solution to an aqueous solution of apothesine (1 in 100): a lemon yellow precipitate is produced (distinction from ethyl aminobenzoate and procain hydrochlorid, which form brown precipitates).

Dissolve about 0.1 gm. of apothesine in 5 c.c. of water, add 3 drops of diluted sulphuric acid and 5 drops of potassium permanganate solution: the violet color of the latter disappears immediately (distinction from cocain, which gives a violet precipitate).

Dissolve 0.1 gm. of apothesine in 1 c.c. of sulphuric acid; the solution remains colorless (organic impurities).

Dissolve 0.1 gm. of apothesine in 10 c.c. of water and saturate the solution with hydrogen sulphid: no coloration or precipitation is produced (salts of heavy metals).

Incinerate about 0.5 gm. of apothesine, accurately weighed: not more than 0.1 per cent of residue remains.

**POTASSIUM MERCURIC IODID.**—Potassii Hydrargyri Iodidum, Potassium Iodomercuriate. A complex salt, $K_2HgI_4$, formed by the interaction of one molecule of mercuric iodid with two molecules of potassium iodid and containing about 25.5 per cent of mercury.

**Actions and Uses.**—Potassiomercuric iodid is used for the same purposes as mercuric iodid over which it has some advantages because of its solubility. As a germicide, it is effective as it does not coagulate albumin. There seems to be no work to show the usefulness of potassiomercuric iodid in the treatment of diseases of the oral cavity. In comparison with mercuric chlorid, it is claimed that it has a greater safety factor. On the basis of animal experiments, it is about one-half as toxic as mercuric chlorid weight for weight; but on the basis of the mercury content, it appears to possess about the same toxicity as mercuric chlorid.

Externally, potassiomercuric iodid is used for skin disinfection, irrigation and disinfection of instruments. In dentistry, its great-

**est usefulness may be found in the cold sterilization of instruments.**

**Dosage.—As a germicide, it is used in the concentration of 1 in 100 to 1 in 10,000.**

*Germicidal Discs of Potassio-Mercuric Iodide No. 1-P.D. & Co.:* Disc-shaped tablets of potassium mercuric iodid containing an excess of potassium iodid, colored blue. Each disc represents mercuric iodid, 0.0971 gm. (1½ grains); potassium iodid, 0.0971 gm. (1½ grains); sodium bicarbonate, 2.9259 gm. (45 grains).

Prepared by Parke, Davis and Company, Detroit, Mich. No U. S. patent or trademark.

*Germicidal Discs of Potassio-Mercuric Iodide No. 2-P.D. & Co.:* Disc-shaped tablets of potassium mercuric iodid containing an excess of potassium iodid, colored blue. Each disc represents mercuric iodid, 0.0283 gm. (⅜ grain); potassium iodid, 0.0283 gm. (⅜ grain); sodium bicarbonate, 1.0368 gm. (16 grains).

Prepared by Parke, Davis and Company, Detroit, Mich. No U. S. patent or trademark.

# USES AND ABUSES OF BARBITALS

The following special article has been prepared as one of a series of articles to be published by the Council on subjects dealing with pharmacology and therapeutics as related to dentistry. The Council has approved the article for publication.

SAMUEL M. GORDON, *Secretary.*

Since the introduction of barbitals into medicine by Fischer and von Mering[1] twenty-seven years ago, their uses have increased steadily, but especially in recent years. The unusual degree of popularity which has been attained by these drugs indicates that they possess definite and dependable actions, with an appeal, however, which puts them under a certain suspicion. They were introduced originally as apparently inoffensive hypnotics, but many more possibilities for their peculiar sedative actions were soon discovered by the laity and practitioners. Today, addiction to barbitals for the sinister purpose of narcotic pleasure and enjoyment is a recognized evil. Professionally, the use of certain derivatives has resulted in some embarrassing, if not unwarranted, forms of experimentation. It may be desirable, therefore, to consider the legitimate uses and their basis, and the possible dangers from, and the abuses of, these drugs.

The chemical composition and properties of the barbitals need not be discussed here. Two of the members, namely barbital and phenobarbital, are official in the U. S. Pharmacopeia, and a number of derivatives are discussed in N. N. R. There are dozens of other barbitals described in medical literature. In fact, each week or oftener an article on some barbital is brought forth. This multiplication of barbitals, from the standpoint of rational and constructive therapeutics, is unwarranted. Although it is true that chemical variations in the barbital molecule have given more or less efficient derivatives, it is also true that multiplication has not been able to controvert that immutable law of pharmacology, namely, that efficiency varies directly with toxicity. Nor has it been possible to amplify the margin of safety in therapeutic usage as the activity of the derivatives has been increased. Thus, the claims of greater efficiency, usefulness and safety for the new and exploited barbitals should not mislead

1. Fischer, and von Mering: Therap. d. Gegenwart, 44:97, 1903; 47:43, 1906.

any one. The truth is that the vast majority of these barbital derivatives are superfluous, if not objectionable, and that the official barbital and phenobarbital can fill every legitimate use and purpose. Use of the others is uneconomical and against public interest, but, no doubt, makes more and greater profits for the manufacturers, by virtue of the copyrighted name.

The proper uses of barbital may be summed up as follows: hypnotic, especially in insomnia of nervous origin; and sedative, in epilepsy, neurosis, hysteria and neuralgia, in preanesthetic medication, in preventing the excitation and convulsions of local anesthetics, for postoperative struggling, nausea and vomiting, and intractable pain, and against tremors, excitations and moderately severe convulsions of disease or poisoning in general. The pharmacologic basis for these uses is a prompt and lasting central depression. The seat of the depression is believed by Pick and Molitor[2] to be in the subcortical regions, including the basal ganglia of the brain, whereas the actions of morphin, chloral and bromid are exerted more predominantly on the cortical regions. This was ascertained rather ingeniously with decorticated rabbits. According to their mode of action, therefore, the barbitals not only eliminate the appreciation of impulses from the external world, but also tend to cut off the central inhibitory impulses. The latter mechanism may explain the considerable excitation, tremors and twitchings in the trunk and extremities not infrequently accompanying barbital medication in both animals and men. Higher doses cause depression of the spinal cord and peripheral nerves with loss of reflexes, circulatory collapse, respiratory depression, considerable fall of body temperature and prolonged sleep. The lasting effects are due to the comparatively slow, though irregular, excretion and destruction of the drug. Curiously, barbital, according to Eddy,[3] may act as a diuretic, and thus promote its own elimination. The excretion is greatly assisted by water drinking and the injection of saline solutions; also by intravenous dextrose, as reported recently by Johnson, Luckhardt and Lighthill.[4] These facts are worth remembering in connection with the treatment of barbital poisoning, for the action and toxicity last only so long as the drug remains in the body. The low solubility of the barbitals does not prevent or greatly affect their absorption, since this is rather rapid from the intestine,[5] and drowsiness and sleep occur in from fifteen to thirty minutes after administration. The degree of alkalinity necessary to dissolve the barbituric acids is decidedly greater than that possible in the blood and tissues. After injection, therefore, they must be precipitated, or exist in some colloidal state, in the body. For this reason, intravenous injection, which has been advocated for systemic anesthesia with a certain derivative,[6] is objectionable and dangerous. This use is improper, for, besides requiring a small surgical operation and aseptic technic, the dosage must be high in order to cause a definite and general depression. Generally some other anesthetic is necessary to complete the anesthesia. The anesthesia may only be attained at the expense of general

2. Pick and Molitor: Jahresk. f. ärztl. Fortbild., 1929, pp. 66-81.

3. Eddy, N. B.: J. Pharm. Exper. Therap., 37:273 (Nov.) 1929.

4. Johnson, C. A.; Luckhardt, A. B., and Lighthill, J. A.: J. A. M. A., 95:576 (Aug. 23) 1930.

5. Coronedi, G.: Arch. di Sc. Biol., 12:299, 1928.

6. Zerfas, L. G., and McCallum, J. T. C.: J. Indiana S. M. A., 22:47 (Feb.) 1929; Cur. Res. Anes. Anal., 8:349 (Nov.-Dec.) 1929.

poisoning, considerable circulatory collapse and prolonged postoperative depression with all its undesirable features.

In small doses, the barbitals may be employed as valuable adjuncts in the conduct of anesthesia, both local and systemic. They do not require intravenous injection for this purpose. They can be given by mouth or injected subcutaneously or intramuscularly. All these routes give prompt absorption and action. They may be used profitably in premedication; given some time before an operation to allay apprehension, fear and excitation, to promote induction of smooth anesthesia, and perhaps to diminish the amount of an inhalation anesthetic. Used in doses of from 0.5 to 1 gm., by mouth, barbital soluble (U.S.P.) does not appreciably affect the circulation and respiration.

Premedication with barbitals is particularly useful in the practice of local anesthesia. Here, it prevents the excitatory symptoms of poisoning, i.e., the general excitation, tremors and convulsions, and thus eliminates important contributory factors in toxicity and death. The action is not specific, but has been shown to be effective against cocain, procain and butyn.[7] It is not to be supposed that premedication with barbitals eliminates all danger of toxicity with local anesthetics. Barbitals only prevent or decrease the excitant actions, not the depressant, for barbitalized animals can be killed with local anesthetics, although from two to three times the ordinary fatal dose of the local anesthetic may now be required. For this purpose, one barbital offers no advantage over another. Fredet,[8] who appears to have been the first to make use of the sedative action in controlling excitation and in anesthesia, tried several derivatives, but the official barbitals of the U. S. Pharmacopeia suffice for all practical purposes.

It should not be assumed that the beneficial results with barbitals in doses of therapeutic order are exclusive. On the contrary, these are obtained at the expense of general protoplasmic poisoning, which probably is the reason for their high sedative efficiency. Besides causing depression of the central nervous system, anesthetic doses paralyze the vagus nerve control of the heart, depress gastric and intestinal motility, decrease the intestinal absorption of sugar, reduce the consumption power of skeletal muscles for sugar, depress smooth muscle and may decrease the secretion of urine.[9] Blood pressure is variably affected, but a considerable and sustained lowering may occur suddenly.[10] Very large doses may cause alarming restlessness, delirium or stupor and even pulmonary edema. Paresis of the tongue is not uncommon and may result in cyanosis and asphyxia. Toxic doses are reported to cause an arsenic-like paralysis of

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7. Knoefel, Herwick and Loevenhart, A. S.: J. Pharm. & Exper. Therap., 39:397, 1930. Tatum, A. L.; Atkinson, A. J., and Collins, K. H.: J. Pharm. & Exper. Therap., 26:325 (Dec.) 1925.

8. Fredet: Paris méd., 57:479, 1925.

9. Shafer, G. V.; Underwood, F. J., and Gaynor, E. D.: Am. J. Physiol., 91:461 (Jan.) 1930. Arnell: Compt. rend. Soc. biol., 95:1046, 1926. Olmsted, J. M. D., and Giragossintz, G.: Proc. Soc. Exper. Biol. & Med. 27:103 (Nov.) 1929; 27:289 (Jan.) 1930. Hines, H. M.; Boyd, J. D., and Leese, C. E.: Proc. Soc. Exper. Biol. & Med., 27:278, 1925. Gruber, C. M.; Shackelford, H. H., and Eckland, A. M.: Arch. Int. Med., 36:366 (Sept.) 1925. Gruber, C. M., and Coherts, S. J.: J. Pharm. & Exper. Therap., 27:327 (May) 1926. Gruber, C. M.: J. Pharm. & Exper. Therap., 33:201 (June) 1928. Ogden, E.: Proc. Soc. Exper. Biol. & Med., 27:506 (March) 1930.

10. Gruber, C. M., and Baskett, R. F.: J. Pharm. & Exper. Therap., 25:219 (April) 1925; J. Lab. & Clin. Med., 10:630 (May) 1925.

capillaries[11] and mucoid degeneration of the brain.[12] In other words, the barbitals cause widespread depression or paralysis of living tissues, i.e., they cause a general protoplasmic poisoning. It is no wonder that collapse and death have been frequently reported; but these are especially to be feared with overdosage, or careless and repeated administration, and particularly with intravenous injection. For these and other reasons, already mentioned, the use of barbitals intravenously for clinical anesthesia is an unwarranted form of experimentation. With smaller doses, prolonged stupor, vertigo, lassitude and skin rashes are common, but generally not dangerous, although these symptoms may be disconcerting to the patient as well as the practitioner. It is obvious that the use of the barbitals, as aids in systemic and local anesthesia, is fraught with a certain amount of danger, but here, as elsewhere, the practitioner should bear in mind that a drug is a two-edged sword, and that there is no such thing as a nontoxic sedative which may be used with impunity.

Equally, or more, important are the abuses which may arise from the careless prescribing or recommending of barbitals, and of the mixtures containing barbitals and various antipyretics and analgesics, such as acetylsalicylic acid, amidopyrin and acetphenetidin. Habituation to barbitals is now well recognized. Last year, legislation was enacted in California which prohibits the sale of barbitals except on a physician's prescription. A license is required and a prescription cannot be refilled without physician's orders. Recently, similar legislation has been enacted by the State of Virginia. The Sanitary Code of the City of New York prohibits the sale of certain barbitals without a physician's prescription. Federal legislation is undoubtedly desirable. While legislative control can do a great deal in protecting humanity against narcotic abuse, perfection can be approached with the intelligent cooperation of qualified practitioners of both dentistry and medicine. It must never be forgotten that habituation to hypnotics is easily acquired, and this is especially true of the barbitals because of their palatability, the comparative ease and convenience of bringing on their action and a fair margin of safety. On the other hand, the tolerance to barbitals as compared with other narcotics is low, and therefore accidents and unexpected difficulties during medication are apt to supervene. The situation is not made better by diluting or mixing barbitals with other sedatives, for the reason that the components of such mixtures may potentiate or increase one another's actions. These peculiarities in the actions of barbitals probably account for the accidents at the hands of inexperienced, solicitous and ignorant practitioners. The limit is reached with deliberate and promiscuous medication with these drugs alone, or in mixtures; for this not only promotes habituation but may also mask the symptoms of diseases and prevent its timely recognition and proper treatment. The intelligent, thoughtful and proper use of barbitals, in fact, sedatives in general, indeed reflects not only the training, but also the character, of the practitioner himself.

11. Jacobj and Roemer: Arch. exp. Path. Pharm., 1911, 66:261.

12. Mott, F. W.; Woodhouse, D. L., and Pickworth, F. A.: Brit. J. Exper. Path. 7:325 (Oct.) 1926.

# BUREAU OF DENTAL HEALTH EDUCATION

## TREATMENT OF SENSITIVE CERVICES OF TEETH

By SIGMUND W. A. FRANKEN, D.D.S., New York City

PATIENTS having sensitive cervices of teeth present a condition which is the bugbear of dental practice, since it is one of the most difficult to treat successfully. That it is usually brought about by metabolic disturbances is evidenced by its prevalence during the premenstrual period, pregnancy and lactation, and its possible incidence as an aftermath of such infections as typhoid, pleurisy and tuberculosis. It has also been found that changes in the mouth and teeth occur in cases of endocrine dyscrasia —ovarian, thyroid, pituitary and, possibly, parathyroid. In connection with the foregoing, reference is herewith made to the works of Biedl, Blair Bell, Cushing, Swale Vincent and Sajous,[1] who, while they do not make specific mention of sensitive teeth, note various alterations occurring in the buccal cavity, affecting, for instance, the size of the jaw, the spacing of the teeth and even the color of the teeth. Sir Arthur Keith[2] has also written on changes in the jaws and teeth brought about by metabolic disturbances.

Demineralization of calcium by feeding a low calcium diet, or by administration of the parathyroid hormone of Collip,[3] changes the number and size of bone trabeculae. This has been well illustrated by Aub and his co-workers[4] by experiments with alizarin red. These experiments demonstrated the breaking up of the trabeculae of the long bones of animals kept on the demineralization diet, and a redeposit after the diet had been restored to normal. McCarrison[5] has shown that a vitamin-deficient diet may affect various tissues and organs of the body and cause, for instance, thinning and

1. Biedl, Arthur: Internal Secreting Organs, New York: William Wood and Company, 1913. Bell, W. B.: The Pituitary, New York: William Wood & Company, 1919. Cushing, Harvey: Pituitary Body and Its Disorders, Ed. 2, Philadelphia and London: J. B. Lippincott & Co., 1912. Vincent, Swale: Internal Secretion and Ductless Glands, New York: Longmans, Green & Company, 1922. Sajous, Charles: Internal Secretions and Principles of Medicine, Philadelphia: F. A. Davis Company, 1922.

2. Keith, Arthur: Structural Changes Which Are Taking Place in Our Jaws and Teeth, published by Dental Board of United Kingdom in five lectures on the growth of the jaws, normal and abnormal, in health and disease, 1924, p. 133.

3. Collip, J. B.: Therapeutic Value of Parathyroid Hormone, J. A. M. A., 87:908-909 (Sept. 18) 1936.

4. Bauer, W.; Aub, J. C., and Albright, F.: Studies of Calcium and Phosphorus Metabolism; Study of Bone Trabeculae as Really Available Supply of Calcium, J. Exper. Med., 49:145 (Jan.) 1929.

5. McCarrison, Robert: Studies in Deficiency Disease, New York: Oxford University Press, 1921.

distension of the bowels and atrophy of the salivary glands. He quotes from Zilva and Wells,[6] showing pronounced cellular disorganization of the teeth of guinea-pigs kept on a vitamin-free diet, and the disintegration of blood vessels, nerves, cells and odontoblasts, which are replaced by firm fibrous tissue. He also expresses the opinion that the endocrines are profoundly affected by avitaminosis. If this is true, we can easily understand Keith's[2] theory that hypertrophy or enlargement of the tonsils, contraction of the palate and the presence of adenoids and irregularly placed teeth are all due to defective function of the glands supplying the hormones that control growth.

Howe and Wolbach[7] have demonstrated changes in the salivary glands which consist of keratinization of the ducts, and of the glands themselves. Considering that we have ample proof that demineralization causes changes in various parts of the body, including the mouth, the theory may be safely put forth that it may also cause metabolic changes in the teeth, resulting in sensitiveness. This may be further substantiated by the fact that Aub and others[8] state that lead has been found in extracted teeth in cases of plumbism.

Another possible explanation for this condition is that the alteration in the salivary glands[7] probably causes changes in the saliva, which, in turn, naturally modifies the environment of the teeth, and which may have some effect on the external surface of the tooth.

6. Zilva, S. S., and Wells, F. M.: Proc. Roy. Soc. Med., p. 505, 1919.

7. Howe, P. R., and Wolbach, S. B.: Exper. Biol. & Anat., April, 1925.

8. Hunter, D., and Aub, J. C.: Lead Studies. XV. Effect of Parathyroid Hormone on Excretion of Lead and Calcium in Patients Suffering from Lead Poisoning, Quart. J. Med., 20:123-140 (Jan.) 1926.

Mrs. Mellanby[9] has only recently shown the possibility of producing cavities and arresting their development by dietary measures; yet we cannot judge whether this is brought about by an internal change in the tooth or is a result of the environment (saliva).

It is not the purpose of this paper to prove that cervical sensitiveness of teeth is brought about by mineral starvation or avitaminosis, or both, but rather to show the results gained by using the hypothesis as stated as a guide to therapy, and to report the results from an entirely empiric, clinical experience.

Before entering into the question of treatment, differentiation must be made between so-called "idiopathic" sensitive teeth, and those of other types, the etiology of which is known. There is the group in which sensitiveness has been caused by cross-brushing at the cervix, resulting in painful exposure of the cementum. Another type is caused by the use of gritty and abrasive dentifrices. If these procedures are resorted to for a long time, the pulp slowly recedes and the sensi-

Model showing cuspid as typical example of sensitive cervix without sign of erosion or cavity. It is this type that is amenable to the treatment here outlined.

9. Mellanby, May: Diet and the Teeth, Special Report Series, No. 140, 1929.

TABLE 1.—DISTRIBUTION OF THE THREE ACCESSORY FACTORS IN THE COMMONER FOODSTUFFS

| Classes of Foodstuff | Fat-Soluble A or Antirachitic Factor | Water-Soluble B or Antineuritic (Antiberiberi) Factor | Anti-scorbutic Factor |
|---|---|---|---|
| Fats and Oils | | | |
| Butter | + + + | 0 | |
| Cream | + + | 0 | |
| Cod-liver oil | + + + | 0 | |
| Mutton fat | + + | | |
| Beef fat or suet | + + | | |
| Peanut or arachis oil | + | | |
| Lard | 0 | | |
| Olive oil | 0 | | |
| Cotton-seed oil | 0 | | |
| Coconut oil | 0 | | |
| Coco butter | 0 | | |
| Linseed oil | 0 | | |
| Fish oil, whale oil, herring oil, etc. | + + | | |
| Hardened fats, animal or veg. origin | 0 | | |
| Margarin prepared from animal fat | Value in proportion to amount of animal fat contained | | |
| Margarin from vegetable fats or lard | 0 | | |
| Nut butters | + | | |
| Meat, Fish, etc. | | | |
| Lean meat (beef, mutton, etc.) | + | + | + |
| Liver | + + | + + | + |
| Kidneys | + + | + | |
| Heart | + + | + | |
| Brain | + | + + | |
| Sweetbreads | + | + + | |
| Fish, white | 0 | Very slight, if any | |
| Fish fat (salmon, herring, etc.) | + + | Very slight, if any | |
| Fish roe | + | + + | |
| Tinned meats | ? | Very slight | 0 |
| Milk, Cheese, etc. | | | |
| Milk, cow's whole, raw | + + | + | + |
| Milk, skim, raw | 0 | + | + |
| Milk, dried whole | Less than + + | + | Less than + |
| Milk, boiled whole | Undetermined | + | Less than + |
| Milk, condensed, sweetened | + | + | Less than + |
| Cheese, whole milk | + | | |
| Cheese, skim | 0 | | |
| Eggs | | | |
| Fresh | + + | + + + | ? 0 |
| Dried | + + | + + + | ? 0 |

TABLE 1.—DISTRIBUTION OF THE THREE ACCESSORY FACTORS IN THE COMMONER FOODSTUFFS—CONTINUED

| Classes of Foodstuff | Fat-Soluble A orAntirachitic Factor | Water-Soluble B or Antineuritic (Antiberiberi) Factor | Anti-scorbutic Factor |
|---|---|---|---|
| Cereals, Pulses, etc. | | | |
| Wheat, maize, rice, whole grain | + | + | 0 |
| Wheat, germ | + + | + + + | 0 |
| Wheat, maize, bran | 0 | + + | 0 |
| White wheaten flour, pure cornflour, polished rice, &c. | 0 | 0 | 0 |
| Custard powders, egg substitutes, prepared from cereal products | 0 | 0 | 0 |
| Linseed, millet | + + | + + | 0 |
| Dried peas, lentils, etc. | | + + | 0 |
| Peaflour (kilned) | | 0 | 0 |
| Soy beans, haricot beans | + | + + | 0 |
| Germinated pulses or cereals | + | + + | + + |
| Vegetables and Fruits | | | |
| Cabbage, fresh | + + | + | + + + |
| Cabbage, fresh, cooked | | + | + |
| Cabbage, dried | + | + | Very slight |
| Cabbage, canned | | | Very slight |
| Swede, raw expressed juice | | | + + + |
| Lettuce | + + | + | |
| Spinach (dried) | + + | + | |
| Carrots, fresh raw | + | + | + |
| Carrots, dried | Very slight | | |
| Beetroot, raw, expressed juice | | | Less than + |
| Potatoes, raw | + | + | |
| Potatoes, cooked | | | + |
| Beans, fresh, scarlet runners, raw | | | + + |
| Onions, cooked | | | + (at least) |
| Lemon juice, fresh | | | + + + |
| Lemon juice, preserved | | | + + |
| Lime juice, fresh | | | + + |
| Lime juice, preserved | | | Very slight |
| Orange juice, fresh | | | + + + |
| Raspberries | | | + + |
| Apples | | | + |
| Bananas | + | + | Very slight |
| Tomatoes (canned) | | | + + |
| Nuts | + | + + | |
| Miscellaneous | | | |
| Yeast, dried | | + + + | |
| Yeast, extract and autolysed | ? | + + + | 0 |
| Meat extract | 0 | 0 | 0 |
| Malt extract | | + in some specimens | |
| Beer | | 0 | 0 |

tiveness diminishes. As the causes of these two groups are known, it follows naturally that further damage can be prevented by discontinuance of the harmful practices.

The so-called "idiopathic" type includes all teeth not showing any abrasion or other reason for being sensitive. In some instances, but not always, the gingivae have receded slightly. The condition has for years been blindly accepted, but, until recently, was left untreated. This "idiopathic" type may be better named "metabolic," and if the term is modified to mean an imbalance of the mineral metabolism, particularly of calcium, then an empiric method of treatment is easily carried on.

TABLE 2.—DATA ON CASES

| Patients | Age | Treatment | Period Months | Results |
|---|---|---|---|---|
| Male | | | | |
| J.F. | 32 | Calcium Sandoz and vitamin A diet | 3 (Jan.-April ) | Great improvement |
| R. H. H | 48 | Vitamin A diet and milk | 10 (April-Feb. ) | Slight improvement |
| S. R. J. | 27 | Vitamin A diet | 5 (Sept.-March) | Increased sensitiveness |
| E. H. L. | 52 | Vitamin A diet | 7 (June-Jan. ) | Sensitiveness gone |
| L. B. M. | 48 | Calcium Sandoz and vitamin A diet | 7 (June-Jan. ) | Improved during summer months |
| J. M. | 38 | Calcium Sandoz and vitamin A diet | 12 (March-March) | Improved |
| J. O. | 28 | Vitamin A diet | 5 (Sept.-Jan. ) | Slight improvement |
| N. S. | 51 | Calcium Sandoz 9 months, vitamin A diet 4 months | 14 (Feb.-April ) | Sensitiveness gone |
| M. W. | 28 | Calcium Sandoz and vitamin A diet | 3 (Jan.-April ) | Slight improvement |
| Female | | | | |
| Miss E. H. | 36 | Calcium Sandoz and vitamin A diet | 2 (Jan.-March) | Marked improvement |
| Mrs. R. H. | 38 | Calcium Sandoz, vitamin A diet and sunshine | 6 (June-Jan. ) | Stopped calcium after 2 months; no improvement |
| Mrs. F. L. | 32 | Calcium-gluconate Sandoz 3 months, vitamin A diet for 8 months | 9 (April-Jan. ) | Slight improvement |
| Miss J. R. | 31 | Vitamin A diet and sunshine | 10 (May-March) | Slight improvement |
| Mrs. J. D. | 40 | Vitamin A diet | 4 (Dec.-April ) | Improved |
| Mrs. K. B. | 29 | Calcium Sandoz and Vitamin A diet | 3 (Jan.-April ) | Slight improvement |
| Miss M. K. | 23 | Calcium Sandoz and vitamin A diet | 12 (May-May ) | No improvement |
| Mrs. T. F. | 32 | Calcium Sandoz, lime water and vitamin A diet (pregnant) | 11 (March-Feb. ) | Sensitiveness gone |

How do people become demineralized? This can best be understood by recalling the classic remark made, I believe, by McCollum: "The American people are starving themselves on a full stomach." Of course, this held true ten years ago,

and although much has been said since then advocating the inclusion of the vitamins in the diet, it is still true, but possibly owing to another factor, namely, constant eating in hotels and restaurants, where vegetables and greens are overcooked and served soft, without the essential juices. When these culinary habits prevail at home, the result, naturally, is the same.

The following facts have been brought out by McCollum[10] and others, as accessory factors in metabolic changes: (*a*) pregnancies, especially when in rapid succession; (*b*) long continued infectious diseases, such as typhoid and tuberculosis; (*c*) excessive or long continued hemorrhages; (*d*) neuroses and nervous irritability, etc.

A treatment for painful erosion cavities suggested several years ago has been found eminently satisfactory,[11] and is at this point again brought forward because of improvements which make it applicable not only to erosion cavities, but to these painful cervices as well. This treatment has been adhered to in the ensuing years, but occasionally progress has been found to be slow; or, in other cases, it has prevented the involvement of additional teeth but did not help those already afflicted. About two years ago, "calcium-gluconate-Sandoz"[12] was substituted for calcium lactate, with marked success.

Calcium gluconate is the calcium salt of gluconic aid, an oxidation product of glucose. It contains 9.3 per cent of elementary calcium. The gluconic acid is split in the body and completely burnt up, so there is no possibility of undesirable by-effects due to the acid radical. For oral administration, it is available in the form of a tasteless powder or palatable tablets containing a small amount of chocolate. Both forms are easily accepted even by fastidious patients and are eminently suitable for long continued administration. They cause no digestive disturbances, and the usual constipating effects of oral calcium medication, which has been objected to, does not exist with calcium-gluconate.

The dose of the powder is a teaspoonful three times a day in orange juice or water, or two tablets three times a day. The tablets should be thoroughly chewed and followed by a glass of water.

The mere ingestion of calcium does not always mean that the body will assimilate the increased amount offered. This is a physiologic phenomenon, but recently it has been demonstrated that modification of this phenomenon can be satisfactorily effected. Of the various means, that adopted by dentists should be the simplest available. Ultraviolet radiation to influence calcium absorption requires very frequent exposures over the body of increasing duration. Limiting the radiation to the mouth would have but slight influence on the general calcium metabolism. The administration of irradiated inert oils, such as ergosterol and viosterol, is fraught with dangers, among which are the possible formation of renal calculi[13] and deposits of calcium where not desired. In fact, Hess recently expressed the opinion that these irradiated oils should be used only for growing children afflicted with rickets.

10. McCollum, E. V., and Simmonds, Nina: Food Nutrition and Health, Baltimore: Lord Baltimore Press, 1928.

11. Franken, S. W. A.: Successful Treatment of Painful Erosion Cavities, Dent. Cosmos, 66:785 (July) 1924.

12. Report of Council on Pharmacy and Chemistry of the American Medical Association, J. A. M. A., 93:1065 (Oct. 5) 1929.

13. Clausen, Ethel M. L.: Therapeutic Value of Radiation, Medicine, 8:419 (Dec.) 1929.

The remaining avenue of approach for dentists is by means of the diet, through the accessory food factors or vitamins as originally developed. These at first consisted of vitamins A, B and C, but have recently been still further investigated, with the results that various subdivisions have been found and additional alphabetical symbols designated for identification. For our purpose, those foods rich in fat-soluble vitamin A (recently further identified as vitamin D, or the antirachitic vitamin, since the vitamin A foods usually contain the new vitamin D) contain the necessary catalytic agent for calcium absorption.

Table 1[14] gives the sources of the various vitamins. The vitamin A foods will be found to consist mainly of raw greens, fruits and fresh vegetables.

The treatment, then, of sensitiveness of the teeth of metabolic origin is by means of calcium-gluconate, three times a day, and the inclusion in the diet of liberal amounts of vitamin-A-containing foods, such as raw greens, fresh vegetables cooked for a minimum period and served with their juices, and a liberal intake of eggs, especially the yolks, milk, cheese, etc., as indicated in the table. It is one of human nature's idiosyncrasies that, given a combination of tablets or powders *and* diet, they usually adhere to it assiduously. The fact that calcium is really a food and not a drug is impressed on the patient at the time of prescribing.

From February, 1929, to May, 1930, seventeen patients who could be followed up were put on the treatment described above and record kept of their age, sex, number of sensitive teeth and surfaces afflicted, and their adherence to the diet and medication. They were recalled every two to three months for prophylaxis, and any change in condition carefully noted. The results are presented in Table 2.

The age range of these patients is from 23 to 52 years, the average age for women being 32½ years, and that for men 39 years. It can be noted that this condition of sensitive teeth is apparently one which attacks people in the third, fourth and fifth decades, which is the period in life during which the hardest work, both mental and physical, is done.

There also appears to be a seasonal incidence in this condition. The sensitiveness has been found to be more severe in the early spring, and to decrease in the late summer and early autumn. An explanation of this may be that in the spring, owing to the lack of sunlight and the ceaseless grind of the past winter's work, besides a deficiency in diet, a calcium depletion and nervous irritability occur. The slowing up of work in the summer, plus vacations, during which much time is spent in the sun, usually restores the teeth to normal. Further proof of this is demonstrated in the case of a patient (Miss J. R.) who stopped the intake of calcium gluconate in the late spring, but spent the greater part of the ensuing months in the sun, and adhered strictly to the vitamin A diet. When seen in September, there was a marked improvement in her teeth, but by December she found it necessary to resume the intake of calcium.

Children do not seem to have this condition of sensitive teeth to any marked degree, but they often develop white crescent-shaped soft areas at the cervices of the teeth. Here cod-liver oil, plus an increased intake of milk, very quickly controls the condition. Of course, cod-liver oil is excellent for adults as an adjuvant

14. Report on the Present State of Knowledge Concerning Accessory Food Factors (Vitamines), London: His Majesty's Stationery Office, 1919.

for calcium absorption, but it is most difficult to convince the patient of it.

For immediate temporary relief of those patients suffering from painful cervices of teeth, there are a few medicaments which may be used, but with great caution. If the anterior teeth are affected, they should be dried, isolated with cotton rolls and a minute amount of pure formaldehyd applied to the sensitive spots with a wooden applicator, such as a toothpick. A stream of hot air should then be blown on the teeth immediately and the patient requested to rinse the mouth with water. This rinsing is important, as any free formaldehyd is thereby washed away. The teeth may then be tested for sensitiveness, and, if necessary, the procedure be repeated. This is rarely necessary at one sitting. It will give relief for several weeks, and sometimes for months. Its continued use is not advisable, since its effect on the pulp may be deleterious. Zinc chlorid is less powerful, but safer to apply. The general methods of its application are the same.

If the posterior teeth are affected, silver nitrate may be employed. It has been used for these conditions over a long period of years, and has been found to be an effective medicament. The crystal form is frequently applied, but a saturated solution is more advisable. The same precautions should be taken as for the application of formaldehyd, to prevent any of the solution or crystal from touching the mucous membrane.

A word may be said on what may actually effect the cures: Some may be brought about by the diet recommended, some by the calcium-gluconate alone and some by their combination. Since this cannot be definitely determined in advance, the patient must be given the benefit of both. When the sensitiveness has subsided, the patient may be permitted to stop the calcium, but advised to continue with the vitamin A diet. If the sensitiveness returns, the original combination of the calcium-gluconate and vitamin A diet should be resumed.

26 E. Thirty-Sixth St.

## PUBLIC HEALTH DENTISTRY IN SANTA BARBARA COUNTY

By LEO MOLLATH, D.D.S., Lompoc, Calif.

As the public health movement grows older, more and more thought is being given to the place that children's dentistry should occupy in a well organized health department. In past years, little attention has been given to the deciduous teeth, partly through ignorance as to their function and partly through the disinclination of the parents to pay an adequate fee for this service. Now, through literature and lectures, a large majority of the population are becoming tooth-wise and are realizing that modern dentistry emphasizes early care for the prevention of dental defects. It is generally accepted that good dental habits can best be taught during preschool and early school ages. There is probably no better organization, then, to take over this phase of dentistry than the county health unit.

In trying to introduce this division into

a health department, there is usually opposition and the taxpayers cannot seem to see the need for dental health education, although they readily accept other health activities.

Early in 1929, R. C. Main, health officer of Santa Barbara County, realized that there was an urgent need in this county for a dental health unit to complete the health education which had been introduced in the schools. The problem was to reach the public and convince them of the need for it. This was accomplished through newspaper publicity, showing what had been accomplished in other counties and giving an estimate as to what the division would cost.

As the governing board of the health department reacted very favorably toward this phase of public health work, after it was fully explained to them, we had little opposition in starting this division.

In introducing the plan, we thought it would be better to start with a small budget, until we could see how the children and the parents accepted the innovation. The program was started in November, 1929, and a portable outfit was used, consisting of a chair, student instrument case, foot engine, electric engine and the necessary dental supplies, the cost being $423.78. This was transported from school to school in a Ford de luxe delivery car. In visiting the schools, a number of obstacles arose; for instance, the work had to be carried on in either the teachers' rest room, in the classroom itself, and even, in some cases, in the schoolyard. Operating under these conditions was often unfavorable, owing to poor light and the absence of water and electricity; also, it often interrupted classroom work and caused a loss of operating time. When the introductory work was done, we looked forward to the time when we could have a mobile unit to facilitate the work. The program this last year was so favorably received, by both the children and their parents, that the supervisors of the county and the department have now provided for a mobile unit. Much thought was given to the type of equipment and motor unit to be used and a trailer was decided on in preference to a truck. The trailer used is built by the Curtis Aeroplane Co., of Detroit, and is of the two wheel type with a special coupling which eliminates all side sway and torsion. It was felt that the trailer would be superior to the truck in that it could be uncoupled and left at the school, which keeps down the operating cost and subjects the equipment to less wear and tear, and provides greater speed of transportation. The trailer also affords greater floor space and better light and ventilation.

The operating equipment in the trailer consists of a modern type of unit and a child's chair. The instrument cabinet and desk are built in. Provisions have been made so that gas, air and water are available at the chair. This has been accomplished by the mounting of tanks underneath the trailer. The unit has a special wound motor to be operated on six volts, the current being supplied by batteries mounted in the tow car. Sterilization is accomplished by a gas-heated steam sterilizer. The interior of the trailer gives a picture of a complete dental operating room and business office, with all the necessary conveniences, and does not depend on any outside source for its operation. The completed mobile unit cost $3,810.

It may be interesting to know how we carry on our work. The public health nurses give cards to the children in the schools, to be taken home for the parents' signature authorizing and requesting dental service. About a week later, our mobile unit is taken to the school and all children whose parents request this service

are examined. As the cases are examined, an individual record is made of the cavities present and the condition of the oral tissues. A notice of the findings is then sent to the parents urging them to cooperate with us and have the defects corrected by taking the child to the family dentist. The individual record card is designed to keep an eight-year record of oral conditions, so that a comparative survey may be made at any time. The records which we are using are a combination of several that are in use in this state. At the time of the examination, the child's teeth are cleaned and instruction is given in the use of the toothbrush. This is supplemented by instructions given by the public health nurses. The reparative and preventive work done at the schools is not limited to those children who could not otherwise have it done, but is given to all children, as we feel that the demonstrative practice brings greater accomplishments than just lecturing. To remove the decaying roots and thoroughly clean the teeth often gives the child his first conception of what a clean mouth feels like, and, with this start, he is easily encouraged to adopt valuable habits of oral hygiene.

It has been my plan to visit the dentists in the towns and explain to them what we are doing and ask for their cooperation. They have all been much interested in the work and have noticed a marked increase in the number of child patients in their practice after I have visited the schools in the community.

To show that something not only needs to be done but also must be done if we wish to prevent dental defects in the children of this generation, let me quote some of my findings for the first six months of this work. Of 2,195 cases examined, only 617 did not need reparative work. In the remaining 1,578 cases, 5,723 cavities were found. Of the 2,195 children examined, 211 were Japanese, 482 were Mexicans and 1,502 were white. The following figures will show what has been accomplished in the 1,578 cases: 1,208 teeth were extracted (mostly deciduous teeth); 889 cement and 705 silver fillings were placed, and 329 silver nitrate treatments were given.

## DENTAL ASSISTANT AND CHILD PATIENT

By KATHERINE CARR, Kenilworth, Ill.

LET us look at the subject, "The Dental Assistant and the Child Patient," from the assistant's point of view first of all. A love for children is her chief asset, for without that one cannot expect to obtain a child's confidence and liking. Do not think for one moment that a child cannot detect this lack of love and sympathy by some mysterious sixth sense. A calm, unruffled attitude, no matter how trying a child may be, and a happy, cheerful smile are attributes an assistant will find useful in eliminating fear of a dental office from a child's mind.

The patients requiring exceptional study are the children. They are a problem; because, in their care, there is a definite place for education. The management of a crying, hysterical child is a very different thing indeed from the management of an adult under similar circumstances. One of the secrets of child man-

agement lies in treating them as though they were grown up. Let them think for themselves and help decide the best course to take. Children are extremely sensitive to ridicule; we may laugh with them, but not at them. Interest in a child's activities, sports or school work, seems to help in diverting the child's mind from what the doctor is going to do and lessens the natural fear that has been instilled in the child's mind by some grownup or a playmate, who is not averse to letting the imagination run away with him. We often hear mothers say, within the hearing of the child, "I can't blame Jane for being frightened, I am a perfect coward myself." Is that being fair to the child? Fear is a natural instinct and one of which we need not be ashamed; nevertheless, it would appear better judgment to speak with discretion when in the presence of children. A child coming to the dental office for the first time is either frightened by stories told by other children or by a mother's constant repetition, "The doctor will not hurt you." That word "hurt" is taboo in our office. If we are asked, "Is it going to hurt?" we answer truthfully, "Yes, a little," or, "No, not at all"; for a child loses all confidence if he thinks that you have not told him the truth. May I emphasize above all that it is important to gain and keep a child's confidence; there is nothing more precious. One should make every effort to preserve this confidence by never breaking a promise made to a child.

The first time a child comes to the office, he is often received, talked to and examined in the reception room, and by the second or third visit, the child has no fear of the dental chair and accepts the invitation to climb up in the elevator for a ride. Teeth are not mentioned, but many other things are spoken of, until the child has regained a little of his poise and confidence. In case of an emergency or a toothache, a patient's fear can be overcome by a matter-of-fact reception, with only a casual question about the offending tooth, stress being put on the fact that the doctor can stop the pain only if the patient will help by sitting still and letting him treat the tooth.

We encourage mothers to make a practice of bringing the little children with them when they have an appointment, and thus the child becomes accustomed to the office, the dentist and the assistant, and has no fear when dental work is necessary. I have a case in mind of a little boy of 3 who insists on the doctor's looking at his "teef" and feels quite neglected if the examination is overlooked. It is nothing unusual in our office for the children in the neighborhood to come in after school, the mother knowing nothing about it, to have the doctor extract a deciduous tooth or give a prophylactic treatment, or maybe they come in just for a little visit. We are never too busy to see these children.

The problem of entertainment bothers us not at all, as most of the children are neighbors or go to the same school, from grammar grades through high school, and Saturday mornings and weekday afternoons from 3:30 to 5:30 find our office a meeting place. And do we have a hubbub! One trying to outtalk the other, doctor and assistant included, and all coming early so that they can visit regardless of what time they have an appointment. We experimented with a block puzzle for entertainment and found it a huge success, so much so that the children of all ages were perfectly willing for the doctor to do almost anything to their teeth if he would only hurry and they could come back for another trial at the puzzle. For the little tots, who usually come with their mothers, we have colored chalks and a small blackboard. The various chil-

dren's pictorial books, magazines and a box of building blocks prove a great attraction for the 6-year-olds, although we try not to keep them in the waiting room until they grow impatient and fidgety, for, as you know, ten to fifteen minutes is a long time for any small child to sit still.

When the drill is first used, it is introduced as a large bee, busily working and humming, and perhaps it will sting a little bit, as all bees do, but as soon as he does that, he will be returned to his hive. The child is so interested listening to the hum, he forgets about the hurt; in fact, he often triumphantly says, "He didn't sting me." The hypodermic needle is a mosquito, who certainly must be swatted if he bites too hard. As the children grow older, they are interested in what is being done to the tooth, so we give them a mirror and tell them to watch each step in the mouth mirror, the assistant explaining as the work progresses. It is all fun, and for that reason we have one of the quietest of dental offices, for the patient is too interested to waste time on tears, moans or screams. The other day a child with a roving tongue needed a cement filling in a right lower molar. So while holding the cotton rolls, I suggested that the tongue go visiting the teeth on the left side and stay there until the doctor told him the cement sidewalk on the right side was dry. He was so busy trying to stay over on the left side, that we were able to keep the cavity dry. Another child who had a bad habit of wanting to swallow when cotton rolls were in the mouth and then, of course, choking, was greatly surprised to have the assistant tell him, with mock severity, that those cotton rolls belonged to the doctor and if he swallowed even the littlest one, the doctor would have to charge it to his father. The child gave the doctor an astonished look, offered to hold the cotton rolls and has not choked on one since. All instruments are explained to the child before they are used. We find it saves time to explain as we go along. I am sure you have all heard the questions, "What's that for? What will you do next?"

The first or second visit may not find much accomplished, save easing a toothache perhaps, but we have gained a child's confidence, and he knows that in coming to the dentist's office, he will not be "murdered" as one of the boys said he expected to be, and that the dental office, instead of being a chamber of torture, is a place reflecting harmony and ease. That is what we work for in all cases, harmony and the child's confidence, and when that is gained, the rest is easy sailing. They know that we are trying to help and not to hurt them and the dentist is not someone of whom to be afraid, after all.

The children are the adult patients of the future and are wonderful practice builders. If they like the dentist and the assistant, they are very loyal to the office. Briefly summing up all that I have said resolves itself into winning the child's confidence, through understanding and sympathy in a natural and unaffected manner, because you love children and you love your "job."

419 Richmond Road.

# DENTAL ASSISTANT AND ADULT PATIENT

By SYLVIA DANENBAUM, New York City

THE dental assistant has become an important adjunct to the proper conduct and upbuilding of a dental practice. Born of necessity because the dentist required assistance in meeting his ever-increasing responsibilities, she has proved her worth through her adaptability, skill and conscientious attention to her duties.

These duties are numerous and include service to the patient as well as to the dentist. As secretary and bookkeeper, she relieves the dentist of a large draft on his time and energy, releasing him for operative work. As guardian of the sterilizer, she assures the cleanliness and asepsis of the operating room and its equipment. In the laboratory, she again saves time and expense; and, at the chair, as the second right hand of the operator, she has many opportunities to be of service through the exercise of her resourcefulness and intuition in anticipating the needs of the operator, and in little attentions which add to the comfort of the patient.

The assistant's value as a practice builder lies in her ability to care for the patients. The patient in the office of the dentist demands the presence of a woman, as does the patient in the office of the physician. Her attendance inspires confidence and alleviates to a great extent the nervous strain which seems a part of a visit to the dentist. With few exceptions, the adult patient carries with him to the dental office the memory, conscious or subconscious, of a past disagreeable experience, or the story of someone else's experiences, which creates a fear of the dentist. It is this fear, this resistance, that the assistant can overcome by intelligent care of the patient before he enters the chair and during treatment.

The experienced dental assistant has the good sense to realize that all patients cannot be treated alike. There are as many ways of dealing with people as there are types of people. A dependable basis to work on is to "use common sense." A cheerful attitude devoid of professional austerity, being agreeable without overstepping the bounds of dignity, can set the patient at ease and make him feel that he is among friends. The elimination of unnecessary noise and confusion, and avoidance of a display of instruments in the operating room also help matters along.

A keen memory for faces and names is an invaluable aid in establishing a pleasant relationship when the patient returns after a lapse of time. It is gratifying to be recognized immediately and called by name. For the convenience of the dentist, the assistant should note the interests of the patients. A reference in the course of conversation to some special interest or hobby of the patient creates a favorable impression. If memory does not serve, a note regarding such personal details made on the record card or in a notebook, for future reference, helps the dentist to this end. The patient with the child who is studying music, the fond grandmother, the college student, the business man, the

golf or baseball fan, all appreciate attention shown to their particular interests. Incidently, such a foundation for conversation removes the dangers involved in the discussion of politics or religion, both of which are subjects approached by only the rash or the brave.

Diplomacy is required when speaking over the telephone. Since the voice can be heard by others in the room, it is advisable to cultivate the habit of speaking quietly and as briefly and impersonally as possible, without being curt. To the person on the other end of the wire, it is not always what we say, but how we say it, that counts. Personal telephone calls for or by the assistant should be avoided and long telephone conversations considered in poor taste. Answering the telephone is a most important duty of the assistant. It acts as a time saver; it eliminates a tremendous nervous strain on the dentist, and removes a source of annoyance to the patient, whose work is constantly interrupted and delayed if the operator must leave the chair each time the telephone bell rings. The trained assistant can handle all calls on matters pertaining to practice, and, if necessary, consult with the doctor at the chair by means of written messages held for him to read, out of the patient's sight.

It has been found good policy for the assistant to handle finances after the initial arrangements have been made by the dentist. Being a business matter, it is more in keeping with the professional atmosphere of the office, and simpler, for the assistant to care for these details. The patient too feels easier and freer to discuss these matters with her, rather than with the doctor, who is rendering a distinctly professional service. Bad debts are cut down when the assistant handles the collection of accounts. As business manager, she can follow up slow collections and insist on payment with more dignity and thoroughness than can the professional man. The situation is less complicated for all concerned when the secretary diplomatically arranges instalment payments with the patient financially embarrassed for the time being; or forces an impostor to meet his obligations.

In this connection, it is also good policy to refuse estimates over the telephone. Aside from the fact that the conversation is audible to others nearby, including the patient in the chair, few "telephone shoppers" ever become patients. The percentage of loss from refusing to carry on such telephone conversations is small. A simple explanation that no estimate, however approximate, can be given without an examination of the mouth will, in all probability, bring the potential patient to the office. The other would not come in anyway.

When a minor comes to the office unaccompanied by an adult for examination, it is wise, and necessary under the law, to obtain a definite confirmation from the parent or guardian before treatment is commenced. This can easily be taken care of by the assistant.

Much can be done by the assistant in educating the adult patient regarding the home care of the teeth. Under the direction of the dentist, she can teach the use of toothbrush, dentifrice and dental floss, the need for proper diet, prenatal care, consistent dental care, etc., facilitating matters so that the dentist can utilize the time so saved for dental procedures which require specialized skill. The patient appreciates this service from the assistant, considering it in the same light as the service of the nurse in the physician's office.

A system of recall for prophylaxis is a useful and necessary part of efficient office

management. A simple card system can be arranged to suit the needs of the office. One that has proved most practicable contains a card for each patient on which is typed the name, address, most convenient day and hour for appointments and the period of time between treatments. This is indexed by months. Prior to the first of each month, the cards of patients due that month are taken from the file, an appointment is noted on the appointment book, the patient is notified well in advance and a confirmation of at least one week is requested. When the work has been completed the date is recorded on the card and the card then placed in the file in the month when the next visit is due. Recall service is only for patients who request it or have accepted the suggestion. The assistant can best approach the patient with the suggestion for periodic prophylactic treatments, explaining the health value of the habit. As the card system is separate from the regular books, it can be discontinued without disarranging the records whenever the patient shows indifference or unwillingness to comply with the notifications. Although this recall service may seem a small detail, it is important in the practice of preventive dentistry, as well as being instrumental in maintaining the practice.

The trained assistant's knowledge of first aid comes into play most usefully in emergencies, particularly in cases of hysterics and fainting on the part of woman patients. No disruption of the planned schedule for the day need be made, as the assistant can competently care for the patient while the dentist continues to meet his appointments. The ministrations of the assistant in such cases is valued, and sometimes preferred, by the patient, who perhaps finds it of greater comfort to be cared for by one of her own sex. The American Red Cross offers a course under the instruction of physicians which is excellent training for the assistant.

The duties of the dental assistant vary with the demands of the individual office. Whatever these may constitute, her aid is invaluable and indispensable to good office management, and the trained, competent assistant merits her place in dentistry.

635 West 174th Street.

## WHAT THE LIBRARY BUREAU* OFFERS YOU

JOSEPHINE P. HUNT, Librarian

THE activities of the American Dental Association have increased to such an extent that there seems to be need for clarification of the services rendered by the various bureaus.

The Library Bureau, which was organized (under the name of Department of Literary Research) in March, 1927, has as its functions the circulation of dental literature, the answering of questions pertaining to dental literature and the selling of books. Many times, inquiries are addressed to the Library Bureau regarding analysis of various products. The Library Bureau can supply data on dental remedies only when articles re-

*Located at 58 E. Washington St., Chicago, Ill.

garding the product have appeared in the dental literature. When information is required regarding proprietary remedies and their therapeutic claims, the Bureau of Chemistry and not the Library Bureau should be addressed. At times, information is asked on developing dental service in the schools. The Library Bureau can furnish clippings describing the school dental service which is being given in a number of communities, but cannot offer suggestions from personal knowledge or experience on the organization of dental services. The Library Bureau can furnish information only after it has appeared in print. Where personal advice or assistance is needed in developing educational talks, or state or community health programs, the Bureau of Dental Health Education should be addressed. The Bureau of Dental Health Education also sells reprints, rents and sells slides and rents films; all suitable for educational purposes. They also have posters, etc. A list of the material available from the Bureau of Dental Health Education will be sent on request.

Stated briefly:

THE BUREAU OF DENTAL HEALTH EDUCATION

Offers suggestions and counsel in the promotion of state and community dental health programs.

Supplies educational material such as reprints, lectures, talks, posters, slides and films to dentists, hygienists, teachers, nurses and other public health workers.

Gives advice and assistance in developing talks and lectures pertaining to dental hygiene for various types of audiences.

THE LIBRARY BUREAU

Circulates dental books and package libraries to members. (Each package library is a collection of periodical clippings, reprints, etc., on one phase of dentistry; over 200 phases have been covered.)

Sells books pertaining to dentistry at publishers' list prices.

Answers questions regarding dental literature.

THE BUREAU OF CHEMISTRY

Investigates old and new dental remedies as presented to the profession and the public.

Furnishes chemical data on "secret" formulas.

Since its organization, the Library Bureau has sent material to or answered inquiries from more than 2,200 individual members. There is no charge for borrowing books from the Library Bureau, but a $2.00 deposit is requested at the time that books are asked for. This is refunded when all books have been returned.

No deposit is necessary in borrowing package libraries, but there is a rental fee of 50 cents for each package. This should be sent with the request for the package.

Books are sold at publishers' list prices. The purchase price of the book should accompany the order. The selling of books by the Library Bureau is the most recent of the three types of service which are being given, but it has already proved very popular. In the back of the present issue, page 193, a selected list of 1930 books with their price is published. Dental books other than those listed may be purchased from the Association. The books included in the list are 1930 books that have proved extremely popular. In the back of the October, 1930, issue of THE JOURNAL, pages 1970-1973, a list of the subjects on which package libraries have been compiled will be found. The November, 1930, issue of THE JOURNAL, pages 2159-2163, contains a list of the recent books available for circulation.

# CURRENT LITERATURE

## EXTRACTS AND ABSTRACTS

*Aberrant Salivary Gland in Tonsil Fossa:* A case of aberrant salivary gland in the tonsil fossa is reported by R. S. Tillotson (*California and West. Med.,* October, 1930), who states that, after careful review of the literature, he found no similar case, although Neuman (*Wien. Med. Wchnschr.,* May 12, 1928) reports a case in which, after tonsillectomy, he discovered a salivary gland located above and behind the upper pole of the tonsil. In Tillotson's case, an adenotonsillectomy was performed under ether anesthesia on a boy, aged 10 years. After enucleation of the left tonsil by the dissection and snare method, the fossa was inspected for hemorrhage, and, on retraction of the anterior pillar, a lobular mass of tissue was noted in the inferior portion of the fossa, which was at first taken to be unremoved tonsil tissue. On dissection, it was noted to extend outward and backward through a separation in the fibers of the superior pharyngeal constrictor muscle which forms the floor of the fossa. With better exposure of the mass, its gross resemblance to salivary gland tissue rather than tonsil was noted. A portion, approximately 1 cm. in each of its three diameters, was removed with a snare, further dissection and removal being considered inadvisable on account of the proximity to the large vessels and nerves of the neck. Microscopic section of the tissue showed mixed salivary gland tissue consisting chiefly of mucous alveoli. Considerable round-cell infiltration was noted around the secretory ducts. The author reports the case in the interests of diagnosis and as a morphologic variation of the tonsil fossa.

*Oral Sepsis and Ocular Disease:* Increased lacrymation, blepharitis, episcleritis of the subconjunctival variety, ulceration of the cornea, iritis and cyclitis have, in a number of cases, been found to be due to the presence of oral sepsis (A. F. MacCallan, in *Pub. Health,* October, 1930), which may be a factor in association with a specific disease condition; or one of the two associated conditions alone may be entirely responsible for the ocular disease. In such diseases as cataract, glaucoma and thrombosis of the central artery or vein of the retina, cure cannot be expected from elimination of a septic focus, but the condition may be ameliorated or arrested thereby. When other possible sources of ocular disease have been eliminated, oral sepsis should certainly be given every consideration. Certain ocular signs frequently associated with oral sepsis are: slight opacity of the lens, seen after the pupil has been dilated; opaque curtains in the vitreous, hyperemia of the retina about the macula, patches of choroiditis and progressive myopia; each of which may have sources other than focal sepsis. In children, blepharitis, conjunctivitis, ulceration of the cornea, phlyctenular conjunctivitis, keratitis and progressive myopia may be seen in association with gingivitis, stomatitis of specific fevers and caries. In adults, it is usually the presence of carious and septic teeth or stumps, apical abscesses, buried fragments of extracted teeth, impacted teeth, residual sepsis and pyorrhea alveolaris that leads to ocular changes. In hospital practice, in adults, the most frequent sources of infection are chronic gingivitis, pyorrhea, caries and residuary stumps; the less frequent, buried fragments of extracted teeth, impacted teeth and residual sepsis. In private practice, the more frequent cause of oral sepsis is the apical abscess under a crown. Dental roentgenography becomes imperative for diagnosis of many of these conditions. As a preliminary to all intra-oral operations, the teeth should be scaled, all defective teeth removed and a roentgenographic examination made. Bacteria reach the eye through the nasal duct or are absorbed into the lymphatics or veins and are thus carried to the eye. The author believes that the extraction of all defective teeth can be carried out at one operation if

care is exercised. When an inflammatory condition of the jaws or ocular inflammation exists, local anesthesia is contraindicated. Prolonged gas and oxygen anesthesia is advocated, with hospitalization for a week. The use of an autogenous vaccine is advocated only after the septic focus has been cleared up. In view of the fact that impacted teeth have been shown to be infected with a hemolytic streptococcus, the author believes that they should be removed before the resistance is weakened to the point that there is some untoward reaction such as an ocular disintegration, inflammation of the appendix or gallbladder or some blood change. Some forms of residual infection show in the roentgenogram merely as a "feathery" area, in which case cultures may be necessary. Treatment consists of scraping and the use of an autogenous vaccine.

*Diseases of the Tongue:* A need for simpler nomenclature and more definite descriptions in the study of lesions of the buccal mucous membrane is seen by H. C. Lindsay (*California and West. Med.*, October, 1930). Names should convey some idea of the pathology of the condition. Differential diagnosis can be assured only by careful history taking, with the use of stains, cultures, microscopes and an exact recording of symptomatic details. Reactions obtained by therapeutic tests may have to be resorted to in some baffling conditions. Simple lesions are sometimes interpreted as malignant, and occasionally a condition so rare is found that few would be able to recognize it. The author has found that cases apparently due to faulty teeth or excessive smoking and definitely not due to syphilis are not prone to cancerous degeneration to the same extent as when the syphilitic coefficient is present. Drug toxemias sometimes affect the tongue and buccal mucous membranes, i. e., the toxemias produced by the arsenicals and phenobarbital. Jagged teeth, infected teeth and poorly constructed artificial dentures are most frequently sources of traumatism to the tongue. In one case of definite glossitis, it was found, by tying the lower and upper plates firmly to the forearm, that the gum plastic material used in making the plates was an irritant. This defect in the denture, which was of excellent fit, was corrected by additional baking. A dentist who had a congenitally deeply grooved tongue developed a very sore indurated spot in one of the crypts, suggesting cancer or syphilis. A smear revealed Vincent's organisms, and a few applications of arsphenamin in glycerin by swab cleared up the condition. The author believes that foot and mouth disease is sometimes diagnosed as a severe stomatitis. Only when there has been known exposure and other conditions have been ruled out may foot and mouth disease be suspected. Exfoliation of the skin is such a late symptom that it is practically valueless in making an early diagnosis. Other confusing oral diseases are recurrent periadenitis mucosae necrotica and black tongue. The author warns of the possibility of two conditions being present at one time, cancer of the tongue being a frequent complication of syphilis. Surgery in combination with radium implantation is recommended in treatment of sarcoma. The author has had marked success in the treatment of nonmalignant conditions with roentgenotherapy.

*Metaphen:* In order to evaluate the claims made for metaphen as a germicide more powerful than mercuric chlorid when tested on cultures of *Staphylococcus aureus* and *Bacillus typhosus*, an extensive and entirely detached comparative study of commonly used disinfectants and antiseptics was undertaken by K. E. Birkhaug (J. A. M. A., Sept. 27, 1930). He concludes that, *in vitro*, metaphen possesses unusual disinfecting and antiseptic powers, far in excess of those possessed by mercuric chlorid, hexylresorcinol, mercurochrome, tincture of iodin and phenol. It has a low toxicity in the recommended doses (10 c.c. of 1:1,000 alkaline dilution for intravenous administration) and does not precipitate out serum proteins. Because of these superior qualities, metaphen is, he believes, worthy of an extended clinical trial in local infections as well as infections in the blood stream.

*Sensitization Tests:* Among the cases reported by Ramirez and Eller (*J. A. M. A.*, Oct. 11, 1930) in a comparative study of four types of sensitization tests, i. e., intradermal, scratch, indirect and contact, on a series of 500 patients and suspected to be of allergic origin, the case of a dentist, aged 32, who had had a recurrent dermatitis of both hands and face for the previous eight months was reported. There was no history of asthma or hay-fever, but occasional attacks of generalized urticaria. Tests demonstrated the cause of the dermatitis to be ethyl alcohol. A reaction was obtained by the intradermal and the patch methods, but the tests were negative

with the scratch and the indirect methods. Avoidance of contact resulted in a disappearance of the persistent eruption, and renewed exposure caused a recurrence.

*Removal of Lower Denture from Esophagus:* W. L. Collins (*New England J. Med.*, Oct. 2, 1930) reports the case of a man, aged 50, who entered the hospital after a drinking bout, with hoarseness, coughing and choking, pulse 86 and respiration rate 17. The lower denture was missing, and on insertion of a finger in the throat, the physician could feel the tip of the plate. Roentgenographic examination revealed the denture in the upper esophagus. It was removed with difficulty but without anesthesia or the use of instruments. The patient ran a slight temperature for two days, with spasmodic coughing, and was able to leave the hospital in one week.

*General Anesthesia in Dentistry:* According to E. A. Peebles (*Cur. Res. Anes. Anal.*, September-October, 1930), nitrous oxid-oxygen, all things being considered, is the most satisfactory agent to be used for general anesthesia in dentistry. The dental profession, in his belief, has been a very important factor in developing this type of anesthesia. Carbon dioxid, 5 per cent, is almost indispensable in acquiring perfection in technic. Ethylene is easier to administer because more cumulative, but the hazard of explosions is to be considered. Alkalinizing patients with orange juice makes for less postoperative acidosis and nausea.

*Toxicity of Viosterol Used in Rickets in Infants:* Garelly has obtained good results with the administration of viosterol in the treatment of rickets. (*Arch. Espan. d. Pediat.*, June, 1930.) The degree of toxicity of viosterol, however, is not yet well determined and hence the advisability of great care in the dose and administration of the drug. In cases in which it is necessary to administer the drug for a long time, the calcium and phosphate contents of the blood should be frequently determined as an index for the continuance or the stopping of the treatment. The author has never observed toxic phenomena caused by the administration of the drug. He has observed lack of appetite and dyspeptic disturbances as a result of the treatment. As soon as the disturbances appeared, the dose of the drug was temporarily diminished and then slowly increased, without the reappearance of the deleterious effects. The method that has given the author the best results is the following: The treatment is started with a dose smaller than that which is generally advised, and slowly increased (in accordance with the general condition of the infant and with the particular condition of his intestines), until reaching the proper dose (either prophylactic or curative dose).—Abstr. *J. A. M. A.*, Oct. 25, 1930.

## Foreign Literature

*Development of the Enamel (Ludwig Göllner, Deutsch. Monat. f. Zahnheilk., Vol. 48, No. 20, 1930):* This paper deals with the finer details of the process of formation and calcification of the enamel. The investigations were carried out on the teeth of embryos of sheep. The author comes to the following conclusions: The first step in the formation of the enamel is the secretion of a protoplasmic membrane, the so-called membrana limitans epithelialis secunda. Later on, while the prisms are being built, the secretion of this membrane is limited to the periphery of the prisms, thus forming the prism sheaths. The terminal bars consist of the basal end rings of the prisms and of the intercellular bridges. The primary enamel substance (preenamel) is already formed by the ganoblasts and is deposited periodically in the form of larger droplets into the prism sheath. It is assumed that each droplet contains the amount of calcium salts necessary for its final hardening, these mineral salts being present in the form of organic compounds, from which they gradually become freed. Each section of a prism between two transverse striae corresponds to one droplet of primary enamel substance and forms a separate unit of calcification. The interprismatic substance originates from the intercellular substance of the ganoblasts; its calcification takes place from the enamel prisms. In the areas where the original droplets of enamel substance were poorly calcified (lines of Retzius), the interprismatic substance remains uncalcified. When the enamel formation is finished, the basal rings are closed and joined into a membrane (primary cuticle). The Tomes processes of the enamel are artefacts due to a preparatory separation of the ganoblasts from the young enamel.

Rudolf Kronfeld, Chicago.

*Amputation of the Pulp (Erik Hellner, Ztsch. f. Stomatol. Vol. 28, Nos. 8-9, 1930):* The original method of pulp amputation as described by Swiss authors consisted of de-

vitalization of the pulp with arsenic acid and filling the pulp chamber with Gysi's "triopaste," containing formocresol. Other authors suggested removing the crown part of the pulp, under infiltration anesthesia, and then placing triopaste on the pulp stump. The intent in this method is to keep the deeper parts of the pulp alive and so preserve the healing power of the pulp tissue. Hellner used the latter method. Intact human teeth destined for extraction later on were employed. The pulp was removed under procain anesthesia, and triopaste put on the pulp wound and sealed with cement. The teeth were extracted one or two years later, and sectioned. It was found that, on the surface of the pulp, splinters of dentin, resulting from drilling, were fused together by newly formed secondary dentin. Thus, a hard substance covering the pulp end is formed. The use of formocresol, which is an irritant to the tissues, must be given careful consideration. On the one hand, its use may obviate incidental infection during the operation; on the other, it may delay and alter the formation of a hard tissue scar on the pulp surface. In the root canals, the author found the formation of new hard substance on the walls, tissue having the character of cementum and tending to reduce the width of the root canal. In summarizing, the author states that the histologic findings indicate that the root pulp may heal completely after a sterile amputation of the coronal pulp.

RUDOLF KRONFELD, Chicago.

*Vestibular, Intra-Oral Dental Roentgenogram (Hans Scherbel, Ztschr. f. Stomatol. Vol. 28, No. 9, 1930):* Difficulties are often encountered in taking roentgenograms of the posterior teeth of the lower jaw. If the patient is thin and is not overly sensitive, it is usually easy to press down the floor of the mouth so far that a clear picture of the apices of the lower teeth can be obtained. If the patient is fleshy and is sensitive, it is often impossible to press the film down far enough on the inside of the mandible; as the patient will complain of pain and nausea. In such cases, the author recommends putting the film (a regular intra-oral dental x-ray film) in the vestibulum, buccally from the tooth, tipping the patient's head slightly toward the side of the tooth and taking the picture by directing the rays from the inside of the mandible outward. The course of the rays is the same as in the usual method, with the exception that the film is on the outside of the mandible and the rays go from inside outward. The one disadvantage is a slight increase in the time of exposure.

RUDOLF KRONFELD, Chicago.

*Cysts of the Jaws (Dr. Hauberisser, Deutsch. Monat. f. Zahnheilk, Vol. 48, No. 18, 1930):* There are three methods to be considered in operating on cysts of the jaws: (1) radical extirpation of the cyst and primary suture of the overlying oral mucous membrane; (2) excision of the labial (buccal) wall of the cyst, thus saving the epithelial lining of the cyst and transforming the cyst into an accessory sinus of the oral cavity (Partsch); (3) in cases of large cysts of the upper jaw, a radical operation according to Luc-Caldwell (making an open communication to the maxillary sinus). This paper deals with the operation on cysts without relation to a nasal sinus (groups 1 and 2). The total extirpation (method 1) is nowadays used only in the case of small cysts (the size of a pea), whereas, for all larger growths, the method of Partsch (method 2) is used. The classic Partsch operation transforms the cyst into a well epithelialized sinus of the oral cavity. Gradually, owing to the elimination of the cystic pressure, the bone fills in from the bottom and the groove becomes shallower. The author recommends a plastic operation on the mucous membrane in order to hasten the filling in of the defect. He mobilizes the lining of the groove which is present after the typical Partsch operation and stretches it across the entrance of the depression, thus shortening the time necessary for the filling in of the defect.

RUDOLF KRONFELD, Chicago.

# MISCELLANY

## BOOK REVIEW

*A Century with Norfolk Naval Hospital, 1830-1930.* A Story of the Oldest Naval Hospital, the Medical Department of the Navy, and the Progress of Medicine Through the Past One Hundred Years. By Richmond C. Holcomb, M.D., F.A.C.S., Captain, Medical Corps, U. S. Navy. 42 illustrations; price, $6.50. Published by Printcraft Publishing Co., Portsmouth, Va.

This is a most sumptuous volume, and to the book lover it will prove a precious possession. Captain Holcomb is entitled to the thanks of generations yet to come for placing on record so many authentic facts connected with medical service in the Navy. He has evidently been untiring in his research among documents and records connected with the subject, and has formulated the whole in consecutive and concrete order for the benefit of the reader.

After spending many hours in poring over this volume, the reviewer feels that he can do no better in summing it up than to quote from the publisher's statement. "The book is not a cheap book. It is not the kind to be laid aside, forgotten and never touched again. . . . It teems with first source material. It is the kind of book by which one comes in intimate contact with lives of men who have gone devotedly about their tasks anywhere over the seven seas that their duties may take them —men who have consecrated their lives to this service. Medical officers, dental officers, nurses, hospital corpsmen should possess a copy."

We congratulate both author and publisher on producing a volume which is entitled to an honored place in every library as a permanent record of the best tradition in naval hospital service.

## RESOLUTIONS OF THE PACIFIC COAST SOCIETY OF ORTHODONTISTS

### Dental Laboratories

WHEREAS, there has been called to the attention of the Pacific Coast Society of Orthodontists, the prevalence of laboratories which offer to construct orthodontic appliances for the members of the dental profession; and

WHEREAS, in some instances these laboratories offer to plan and direct the treatment of malocclusion of the teeth and practically to diagnose the case; and

WHEREAS, certain dental journals, which presumably are maintained for and by the ethical practitioners of dentistry, carry the aforesaid advertising of laboratories without particular distinction; therefore, be it

*Resolved,* that the Pacific Coast Society of Orthodontists, through its board of directors, take such steps as may be calculated to rectify this abuse of the public welfare and the rights of the dental profession; and that the cooperation of all orthodontic societies of this and other countries be solicited to this end.

### Legislation

WHEREAS, there has been much discussion of special legislation in the State of California which would provide for the licensing of orthodontists for the practice of their specialty without complying with the requirements of the existing California dental law; and

WHEREAS, the Pacific Coast Society of Orthodontists believes any variation in the state dental act or the creation of any new legislation which aims to set up different standards for the orthodontists, the exodontists, the oral surgeon, the prosthetists or other departments of dentistry, to be inimical to the best interests of dentistry as well as to the public; and

WHEREAS, such orthodontic legislation has already been created in the passing of the Arizona Orthodontic Law; and

WHEREAS, the improving or correcting of faults in the occlusion of teeth is recognized as a basic principle of dental practice, it is believed this privilege cannot be legally denied any member of the dental profession now or hereafter; therefore, be it

*Resolved,* that the Pacific Coast Society of Orthodontists hereby records its opposition to any such legislation as that inaugurated in Arizona, or any similar legislation which

may be proposed by any person or group in the State of California, and that the secretary be directed to forward a copy of these resolutions to the Board of Directors of the Pacific Coast Society of Orthodontists for their consideration.

## INTERNATIONAL DENTAL FEDERATION (F.D.I.)

### Exposition of Dental Hygiene, Brussels, 1930

A dental hygiene congress exposition was organized by the General Dental Society of Belgian Dentists aided by the Belgian Red Cross national section for child welfare, the Society for Prevention of Tuberculosis, the Society for Preventive and Eugenic Medicine, the Society for Infant's Welfare, the Leagues Against Venereal Diseases, Cancer and Rheumatism and the Association of Ambulatory Clinics. The opening of the International Exposition of Dental Hygiene by Mr. Bielnick, who was delegated by the minister of the interior and of hygiene, took place on August 7, at Brussels.

The congress was opened, August 8, with Dr. Watry as chairman. Papers were read by Dr. Gosaerts (Belgium), on "Hardiness of the Belgian Population"; Dr. Courtois (Belgium), "Dental Service in a Sanatorium"; Dr. Watry (Belgium), (a) "Activity of the Belgian Red Cross in Dental Hygiene"; (b) "Dental Hygiene, a Disregarded Social Question"; Mr. Lourens-Bosch (Netherlands), "De Nederlandsche Maatschappij voor tandbederf"; Mr. Rowlett (England), "Organization of Dental Hygiene in England"; Dr. Bousquet (France), "Development of a Plan for Lectures on Dental Hygiene to Teachers and Instructors"; Dr. Brun (Norway), "Organization of School Dental Hygiene in Norway"; Dr. Ferrand (France), "Dental Hygiene in France"; Dr. Dreyfus (Switzerland), "Rational Sucking and Its Influence on Mouth Hygiene"; Dr. Konrad Cohn (Germany), "Activity of the German Society for Dental Treatment in Schools"; Prof. Budtz-Jorgensen (Denmark), "School Dental Hygiene in Denmark"; Mr. Shipway (England), "Industrial Dental Service in England"; Mr. Bruske (Netherlands), "Activity of the Dental Hygiene Commission of the F. D. I."; Dr. Watry (Belgium), "Plan for Maxillo-facial Orthopedics in School Hygiene"; Dr. Frison (France), "Presentation of the Dental School Clinic Film of the 'Ecole Odontotechnique de Paris,' Founded by Dr. Frison and Messrs. Lebrun and Sudaka"; Dr. Boissier, "How Our Fathers Treated Themselves."

At the final meeting in the Palais du Academies, at which Minister Baehn presided, Mr. Georges Villain, director of the Dental School of Paris and president of the International Congress of 1931, gave a report on the present state of dental hygiene. A commission formed to consider propositions and resolutions resolved to accept the propositions of the F.D.I. Commission of Hygiene and further to found a Belgian league of dental hygiene. This new league was founded immediately and the organizing committee of the International Congress of Dental Hygiene will take the place of the temporary committee.

The International Exposition of Dental Hygiene was highly interesting in every respect. There was a technical section in which various countries exhibited, the principal ones being Germany, England, France, the Netherlands, Scandinavia and Belgium. An exhibition of drawings was organized and met with great success. More than 2,000 drawings were forwarded to the secretary. A part of the hall was reserved for the exhibit. A commercial section displayed various preparations for the treatment of teeth.

In addition a cinema was displayed daily; six French, one German, two English and a Dutch film being shown.

VISCOUNT DE CASA AGUILAR, *Chairman*, Madrid.
GEORGES VILLAIN, *Secretary*, Paris.
A. L. C. J. VAN HASSELT, *Treasurer*, The Hague.

## NEWS

*Paris Clinic Offered by Mr. Eastman:* Mr. George Eastman has made possible the establishment of a clinic in Paris similar to those that he has already endowed in his home city, Rochester, N. Y., and in London, Rome and Stockholm. The Paris clinic, for which $1,000,000 has been made available, will care for not only dental cases but also throat cases. Mr. Eastman's contribution is to provide for a building and equipment, the site to be contributed by the city of Paris. The residue, if any, is to be used to establish a department of orthodontia for the benefit of indigent children under 16 years of age. It is stipulated

that the clinic shall establish and conduct a school for the training of dental hygienists, and it will afford a postgraduate course or internship for young dentists, especially those who desire to specialize in children's dentistry.

*Disposal of Residuary Estate of Dr. Carr:* On the recent death of the trustee of a trust fund representing the residuary estate of the late William Carr, disposal of a fund amounting to $150,323 was made as follows: After the death of a relative of Dr. Carr, who is to receive a life income from the fund, $115,000 is to go to Harvard College, for the William Carr fund, the income to be applied to research work in the field of medicine with special reference to the application of medical knowledge to the department of dentistry. Of the remainder of the fund, $10,000 is left to the New York Post-Graduate Hospital and $5,000 each to the Travelers' Aid Society, Servants of Relief for Incurable Cancer, St. Andrews' School, Inc., Memorial Hospital and the Reconstruction Hospital.

*Ohio State Dental Society Officers:* The newly elected officers of the Ohio State Dental Society are as follows: president, Henry E. Germann, Cincinnati; president elect, Paul J. Aufderheide, Cleveland; vice president, Alden J. Bush, Columbus; secretary, Edward C. Mills, Columbus; treasurer, Harry Cope, Columbus.

## Deaths

*Ash, Clarence Jacob,* South Bend, Ind.; Chicago College of Dental Surgery, 1903; died, November 16, of heart disease, after a long illness; aged 54.

*Blodgett, J. M.,* Lodi, Calif.; College of Dentistry, University of California, 1892; died recently.

*Butler, S. T.,* Sullivan, Ill.; Louisville College of Dental Surgery, 1889; died August 23; aged 68.

*Erringer, James W.,* Chicago, Ill.; Northwestern University Dental School, 1897; died recently, aged 62.

*Gormly, T. A.,* Mt. Vernon, Iowa; State University of Iowa, College of Dentistry, 1891; died, August 30.

*Jewell, George C.,* Lafayette, Ind.; School of Dentistry, University of Pennsylvania, 1902; died, October 24.

*Mason, L. J.,* Chicago, Ill.; died, November 21; aged 79. Dr. Mason practiced dentistry for eleven years, two of which were spent in practice in Vienna. He gave up active practice in 1884 and established a company for manufacturing dental instruments.

*Merchant, Milton S.,* Houston, Texas; Baltimore College of Dental Surgery, 1893; died, September 30; aged 70.

*Moolton, Raphael J.,* New York City; New York University College of Dentistry, 1898; died, October 11.

*Noble, C. S.,* Arroyo Grande, Calif.; died, October 30.

*Ranhofer, Edward J.,* New York City; New York University College of Dentistry, 1874; died, September 10.

*Schwarz, Elmer H.,* Edwardsville, Ill.; Washington University Dental School, 1900; died, August 3, after a stroke of paralysis; aged 53.

*Whitslar, W. H.,* Cleveland, Ohio; University of Michigan College of Dental Surgery, 1885; Rush Medical College, 1886; died December 11; aged 68. Dr. Whitslar was one of the founders of the School of Dentistry, Western Reserve University and a former dean of the dental school, where he was professor emeritus of operative dentistry and professor of dental history and ethics at the time of his death.

# ANNOUNCEMENTS*

## CALENDAR OF MEETINGS

American Dental Association, Memphis, Tenn., Oct. 19-23, 1931.

American Dental Hygienists' Association, Memphis, Tenn., Oct. 19-23, 1931.

American Dental Society of Europe, Paris, France, July 29-August 1, 1931.

American Society of Orthodontists, St. Louis, Mo., April 21-24, 1931.

International Association of Dental Research, Memphis, Tenn., March 23-26, 1931.

International Dental Congress, Paris, France, Aug. 3-8, 1931.

International Orthodontic Congress, London, July 20-24, 1931.

International Stomatologic Congress, Budapest, Sept. 2-7, 1931.

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Baltimore City Dental Society, January 30-31.

Chicago Dental Society Midwinter Clinic, February 2-5.

Central Pennsylvania Dental Society, at Johnstown, March 2-4.

Dallas Midwinter Clinic, February 16-18.

Great Lakes Association of Orthodontists, Toledo, Ohio, Feb. 16-17.

Kings County Midyear Meeting, Brooklyn, N. Y., February 25-28.

Southern Society of Orthodontists, Miami Beach, Fla., January 13-15.

Southwestern Society of Orthodontists, San Antonio, Texas, January 7-10.

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## STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

### January

Delaware, at Wilmington (14).

### March

Minnesota, at Minneapolis (4-6).

### April

Alabama, at Mobile (14-16).
California State, at San Francisco (8-10).
Connecticut, at Hartford (28-30).
Kansas, at Hutchinson (27-29).
Kentucky, at Lexington (6-8).
Louisiana, at New Orleans (20-22).
Michigan, at Detroit (27-29).
Montana, at Helena (16-18).
New Jersey, at Atlantic City (15-17).
Oklahoma, at Oklahoma City (21-23).
Tennessee, at Nashville (21-24).

### May

Illinois, at Peoria (12-14).
Indiana, at Indianapolis (18-20).
Iowa, at Des Moines (5-7).
Maryland, at Baltimore (4-6).
Massachusetts, at Boston (4-7).
Missouri, at Kansas City (11-14).
Nebraska, at Omaha (18-21).
New York, at New York City (12-15).
North Carolina, at Winston-Salem (4-6).
North Dakota, at Fargo (12-14).
Pennsylvania, at Pittsburgh (5-7).
South Dakota, at Huron (11-12).
Texas, at Houston (12-15).
Vermont, at Burlington (20-22).
Virginia, at Old Point Comfort (11-13).
West Virginia, at Huntington (18-20).

### June

Arkansas, at Little Rock (2-4).
California Southern, at Los Angeles (8-13).
Georgia, at Atlanta (10-12).
Maine, at South Poland (18-20).
Nevada, at Reno (6).
Washington, at Bellingham (June 30-July 1).
Wisconsin, at Milwaukee (9-11).

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## MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Delaware, at Wilmington, January 21-22. W. S. P. Combs, Secretary, Middletown.

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*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Illinois, at Chicago, February 2-3. Address Dental Division, Department of Registration, Springfield.

Kentucky, at Louisville, June 5-10. Robert L. Sprau, Secretary, 970 Baxter Ave., Louisville.

North Dakota, at Fargo, January 13-16. Gilbert Moskau, Secretary, Grand Forks.

## FORMER COLORADO DENTISTS TAKE NOTICE

Colorado now has a yearly registration law, first effective in 1930. The yearly fee is $2. After three years of nonpayment, a license becomes automatically revoked. Reinstatement is subject to the discretion of the board. For further information, address

ZENAS T. ROBERTS, *Secretary,*
Registration Board,
810 Metropolitan Bldg.,
Denver.

## AMERICAN DENTAL HYGIENISTS' ASSOCIATION

The eighth annual session of the American Dental Hygienists' Association will be held in Memphis, Tenn., Oct. 19-23, 1931.

AGNES G. MORRIS, *Secretary,*
886 Main St.,
Bridgeport, Conn.

## SOUTH DAKOTA STATE DENTAL SOCIETY

The forty-ninth annual session of the South Dakota State Dental Society will be held at the Marvin Hughitt Hotel, Huron, May 11-12, 1931.

ERNEST W. ELMEN, *Secretary,*
Sioux Falls.

## INTERNATIONAL ASSOCIATION OF DENTAL RESEARCH

The International Association of Dental Research will meet in Memphis, Tenn., at the Peabody Hotel, March 21-22.

WILLIAM J. GIES, *Secretary.*

## ALUMNI ASSOCIATION OF THE KANSAS CITY-WESTERN DENTAL COLLEGE

The annual meeting of the Alumni Association of the Kansas City-Western Dental College, School of Dentistry, Lincoln and Lee University, will be held March 5-6.

R. J. RINEHART, *Dean,*
Tenth Street and Troost Avenue,
Kansas City, Mo.

## SECOND INTERNATIONAL ORTHODONTIC CONGRESS

The Second International Orthodontic Congress will be held in London, July 20-24, 1931, with headquarters at the Savoy Hotel. A full program of papers and clinics has been arranged and an attractive social program for members and those accompanying them is in course of preparation. Letters setting forth the conditions under which contributions to the proceedings are invited, together with copies of the congress rules and application forms for membership, have been sent to all known to be interested in orthodontics, and the secretary-general (Mr. A. C. Lockett, 75, Grosvenor Street, London, W. 1) will be happy to send all such information to any one applying for it. Regular membership in the congress (cost, £2-2-0 per member) is limited to those who are members of organizations which are component societies of the congress. Subscribing membership (cost £2-2-0 per member) is open to all persons of repute irrespective of society membership. Subscribing members have no right to vote or hold office in the congress.

J. H. BADCOCK, *President,*
A. C. LOCKETT AND B. MAXWELL STEPHENS,
*Secretaries-General.*

## INTERNATIONAL STOMATOLOGIC CONGRESS

The first congress of the Association Stomatologique Internationale will be held in Budapest, Sept. 2-7, 1931.

G. MORELLI, *Secretary-General,*
Budapest, IV,
Városház-ucca 14, félemelet.

## NORTH DAKOTA STATE DENTAL ASSOCIATION

The North Dakota State Dental Association will hold its twenty-sixth annual meeting in the Elk's Club at Fargo, May 12-14.

W. S. SHAW, *Secretary,*
Fargo.

## GREAT LAKES ASSOCIATION OF ORTHODONTISTS

The Great Lakes Association of Orthodontists will hold its next meeting in Toledo, Ohio, February 16-17, at the Commodore Perry Hotel. Among the essayists are V. E. Barnes, B. Holly Broadbent, A. F. Jackson, Howard H. Jackson and H. A. Pullen. A cordial invitation is extended to the dental profession.

E. N. BACH, *President,*
1307 Second National Bank Bldg.,
Toledo, Ohio.
S. A. MACKENZIE, *Sec'y-Treas.,*
1011 Stroh Bldg.,
Detroit, Mich.

## NORTH CAROLINA DENTAL SOCIETY

The next meeting of the North Carolina Dental Society will be held May 4-6, at Winston-Salem.

N. P. MADDUX, *Sec'y-Treas.,*
Asheville, N. C.

## RESEARCH MATERIAL REQUESTED

A research on mottled enamel by the nutrition department of the University of Arizona, with Cammack Smith in charge, is under way. It will be appreciated if any members of the dental profession having extracted teeth of this type will send them to Alex Bard, Chairman, Consolidated Bank Bldg., Tucson, Ariz.

## ARKANSAS STATE DENTAL ASSOCIATION

The next annual meeting of the Arkansas State Dental Association will be held at the LaFayette Hotel, Little Rock, June 2-4.

J. D. JORDAN, *President,*
Little Rock.
I. M. STERNBERG, *Secretary,*
Fort Smith.

## EASTERN ASSOCIATION OF GRADUATES OF THE ANGLE SCHOOL OF ORTHODONTIA

A memorial meeting will be held at the Vanderbilt Hotel, New York City, by the Eastern Association of Graduates of the Angle School of Orthodontia, Monday, January 26.

E. SANTLEY BUTLER, *Secretary,*
576 Fifth Ave.,
New York City.

## DENTAL HYGIENISTS ASSOCIATION OF STATE OF NEW YORK

The New York State Dental Hygienists Association will hold its eleventh annual meeting, May 12-15, at the Hotel Pennsylvania, New York City. An invitation is extended to dentists, and dental hygienists and assistants.

MABEL ERCKERT, *Corres. Sec'y,*
18 E. 48th St.,
New York City.

# REPORT OF THE FÉDÉRATION DENTAIRE INTERNATIONALE COMMITTEE OF THE AMERICAN DENTAL ASSOCIATION

To the House of Delegates, Convening in Denver, Colo.

Monday, July 21, 1930

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At the closing general session of the Seventh International Dental Congress, held in Philadelphia, Pa., Friday evening, August 27, 1926, the affairs of the Congress were brought to a close; and one of the last actions taken in the termination of the Congress and the reestablishment of the Fédération Dentaire Internationale, was the receiving of an invitation from Dr. Henry Villain of Paris, extending the official welcome of his nation for the Eighth International Dental Congress to convene in Paris in 1930 or 1931, the exact date to be left to the decision of the Committee on Organization of that congress. The invitation was unanimously accepted, and the date of the meeting for the Eighth International Dental Congress has since been set for Aug. 3-8, 1931, in Paris, France.

During the 1929 meeting of the American Dental Association, which was held in Washington, D. C., October 7-11, Viscount Florestan Aguilar, president of the Fédération Dentaire Internationale, sought, and was granted, an official opportunity to appear before the Board of Trustees of this Association, as it was his desire to convey greetings from all officers of the Fédération Dentaire Internationale, and to request the Board of Trustees to take such action as, in their opinion, would be conducive to the securing of wide publicity and a worthy representative attendance of our members at the forthcoming congress.

Oct. 7, 1929, formal action was taken by the Board of Trustees to the effect that the personnel of the Fédération Dentaire Internationale Committee of the American Dental Association should be appointed the committee on arrangements for the Eighth International Dental Congress. This recommendation of the Board of Trustees was unanimously approved by the House of Delegates, Oct. 11, 1929.

Having thus reviewed the creation and purpose of the Committee on Arrangements of the American Dental Association for the Eighth International Dental Congress, it is now our desire to present the following for your information and approval.

It is definitely the opinion of your committee that such plans should be adopted as would seem to be most certain of securing the attendance of a large number of our members at the forthcoming Congress: also, that our leaders should not only be granted, but also should embrace, the opportunity to appear on the official scientific and clinical programs of the Congress, not only for the reason that the opinions of our outstanding men should be made available to other nations, but also because they should be present to profit by the contributions to be made by the outstanding authorities of all nations. Any worthy plan should see to it that a fair distribution of these honors are allotted to the various states, and that such representation should include all sections rather than be confined to a few centers.

In order that such a desirable end may be obtained, it is recommended that state advisory committees be appointed, and that each state advisory committee be composed of the following:

1. The expresidents of each state dental society for the years 1927, 1928, 1929, 1930, and the president that presides at the annual meeting for the year of 1931. (In such states as have a provision for the office of president elect, the one that is installed in the year of 1931 shall also be made a member of the state advisory committee.)

2. The secretary who officiates at the state annual session for 1931. The president presiding in 1931 and the secretary presiding for the same year shall automatically be designated as the chairman and secretary of each state advisory committee.

3. The President, President Elect, Secretary and Board of Trustees of the American Dental Association.

4. The president, president elect, or vice president and secretary of the National Association of Dental Examiners.

5. The president, president elect and secretary of the American Association of Dental Schools.

6. The deans of the dental schools.

7. Editors of dental journals.

8. The president and secretary of any component of a state society that has a membership of 1,000 or over.

The duties of the state advisory committee shall consist in aiding the Committee on Arrangements of the American Dental Association to secure members for the Congress and to pass on the authorized number of clinicians to represent their respective states.

Through the Committee on Organization of the Eighth International Dental Congress, we have been advised that it would be appreciated if the American Dental Association were represented in the clinical program with between 200 and 300 clinicians, and it has occurred to your committee that if we would specify the number of clinicians to represent the American Dental Association as the number that are authorized to sit in the 1930 House of Delegates of this Association from each state, the entire question could be simply settled by approving the following recommendation:

That each state advisory committee be authorized to select from its membership a number of clinicians equal to the number of delegates authorized in the 1930 House of Delegates.

In connection with this same recommendation, approval is further requested on the following:

In such instances as state advisory committees fail to submit the names of their representatives to appear as clinicians on the program of the forthcoming congress, previous to the last day of February, 1931, your Committee on Arrangements shall be authorized to select a like number from some other state provided they receive the recommendation of that state advisory committee.

We also ask approval of a third recommendation with reference to clinicians:

That each recognized dental school in the United States be tendered an invitation by the Committee on Arrangements of the American Dental Association to send an individual, or a group clinic that shall not exceed four in number.

### Transportation

As a result of the experience gained by those in charge of the Seventh International Dental Congress, we are convinced that the only way that an appropriate number can be interested in attending the Eighth International Dental Congress is to provide ways and means whereby our members can proceed to Europe and return; first, with assurance of comfort, and, secondly, with information as to what the relative expense of the trip will be, as well as tentative itineraries of the tours that they might wish to take. An opportunity should also be provided for the members to make arrangements a sufficient length of time in advance to secure favorable accommodations, and these arrangements should include supervision of the tour by trustworthy travel organizations, since naturally there will be many from this Association who will be undertaking European travel for the first time.

To bring the foregoing to fulfilment, your Committee on Arrangements has had submitted to them a number of itineraries that outline in detail the type of ship to be engaged, relative date of sailing, time of arrival and duration of stay in Paris, etc. In fact, four general tours have been prepared by several experienced travel companies with the understanding that any variation or modification in the tours can be made to suit the convenience and desire of the traveler.

It is probably advisable in this report to include only an outline of the shorter tours, as suggested by the American Express Company and Thomas Cook and Son. Arrangements are to the effect that the traveler may embark from either Montreal or New York City, or, if he so desires, he may go by way of Montreal and return via New York City, or vice versa. In a general way, the ships will sail either from Montreal or New York in time for

the party to reach Paris on the Saturday before the opening of the Congress on Monday, August 3. The tour includes a stay in Paris until Saturday, August 8, the party leaving that night for Brussels and arriving there on Sunday; leaving Brussels Monday morning for Amsterdam, spending Monday afternoon and Tuesday there: leaving Tuesday night via the Hook of Holland for London; with two days in London, and then home by way of Plymouth, South Hampton or Liverpool, this depending on whether one is returning by way of Montreal or New York City. Duration of tour, thirty days. The plan provides for an inclusive expense, with the exception of the meals at Paris.

It is the recommendation of your committee that the Committee on Arrangements of the American Dental Association for the Eighth International Dental Congress be authorized to conclude final arrangements with the American Express Company in accordance with the report here made and the itineraries submitted, with the understanding that the Committee shall sanction the ship or ships to be utilized, and with the further understanding, on the part of the members, that the figures submitted are for the minimum rates and that there will be an increased amount charged for any cabin above the minimum that the member selects, but that the amount charged above the minimum will not be in excess of the rates published by the steamship company for said cabin.

It is the anticipation of your Committee that those residing in the foreign cities to be visited in the shorter tour will put forth every effort to make the visit of our members both comfortable and instructive, in the same manner as arrangements were made after the Philadelphia Congress for those of our guests from other nations who took the tour inland to Washington, Pittsburgh, Chicago, Detroit, Rochester, New York, Boston and Montreal. Of course, this can be accomplished only by the members proceeding at one time from city to city while in Europe, as they did while in this country.

### Papers

It is the understanding of your committee that the members of our Association who are to be selected to read papers will receive their invitations direct from either the chairman or the secretary of the section before which the contribution is to be read. The F. D. I. regulations governing voluntary contributions require that applications to present such contributions be made to the F. D. I. committee of the A. D. A.

Membership in the Eighth International Dental Congress will be, as it has been in the past, open only to those who belong to a recognized national dental association. Therefore, before one can be approved by the committee on membership for the Eighth International Dental Congress, he must have his dues paid to the American Dental Association in the year in which the application is made for membership in the Congress. The application form, to be filled in by a member and accompanied by the membership fee of $10, should be forwarded to the Secretary of the American Dental Association, 58 E. Washington St., Chicago, Ill., who will certify as to eligibility and take the necessary steps to have the membership card of the Congress placed in the member's possession.

In order to make possible the foregoing suggestions with regard to membership, it is recommended that the Secretary of the American Dental Association be authorized to have printed application forms for membership in the Eighth International Dental Congress, and those in charge of The Journal of the American Dental Association should be authorized to give such publicity as in their opinion would seem to be suitable for the promotion of the interest of the American Dental Association in connection with the development of plans that pertain to the forthcoming Congress.

Since the largest participation in the program of the congress by members of the American Dental Association is to be presented in the form of clinics, your committee made a request of the president of the French Organization Committee for approval of the plan of having all clinicians from the United States give their demonstrations in a single half day in one general group; and this request has been approved. It has since occurred to us that as the gathering is to be an international one, nothing should be presented or approved that might take the form of provincialism: therefore, we ask approval of suggesting to the Canadian Dental Association not that they join us, or that we join them, but that the profession from Canada and the United States unite in giving a clinic in a single half day in a general group,

under the designation "Clinicians from North America." In fulfilment of this last suggestion, your committee asks approval to proceed with such plans as will terminate in the appearance of all clinicians of Canada and the United States under the general designation of "Clinicians from North America" but with special designation of nation, province or state, and city.

Respectfully submitted,

W. H. G. LOGAN,
H. B. PINNEY,
GEORGE B. WINTER,
L. P. ANTHONY,
H. J. BURKHART.

AMERICAN EXPRESS COMPANY

Chicago, Ill.
July 17, 1930.

Dr. Wm. H. G. Logan, Chairman
Committee on Arrangements of the American Dental Association
For the Eighth International Dental Congress.
55 E. Washington St.,
Chicago, Ill.

Dear Dr. Logan:

We submit the attached suggestion for official tours to the Eighth International Dental Congress at Paris for the consideration of your committee with a view to your appointing us as official transportation managers for this congress.

In order to bring before you the advantages of our service we would acquaint you with the following:

*Organization.*—The American Express Company is a world-wide organization. It has seventy-five offices and travel bureaus located in the principal cities throughout this country. In Europe, we have forty offices, with a staff of over 2,000 employes to carry out the needs of our travelers.

*Interpreter.*—Our uniformed interpreters are stationed at the principal ports and railway stations, as well as at the international frontiers, to assist our patrons with the difficulties of languages, customs and governmental formalities.

*Couriers.*—A large staff of capable couriers is maintained. The men are especially selected for their experience, personality and responsibility.

*Financial Responsibility.*—The American Express Company is now affiliated with the Chase National Bank, the world's largest banking institution, having resources of over 3,000,000,000 dollars.

*Experience.*—The American Express Company has had a wide experience, having handled large national and international movements to conventions of this nature.

*Promotion.*—The American Express Company will promulgate all information relative to travel facilities to its various offices so that they can cooperate with your local societies in stimulating and promoting attendance at the Paris Congress.

*Solicitation.*—Our representatives in the various cities will call on the local dental societies and cooperate with them to secure members for this congress. In the smaller cities, this work will be carried out through our connections with the Railway Express Agency, Inc., so that our solicitation will cover the entire country.

*Advertising.*—The American Express Company will prepare and assume the cost of printing of announcements describing the official tours to the congress, such printed matter being subject to the approval of the Committee on Arrangements.

*Information.*—Delegates and members interested in the Paris Congress can obtain complete information as to their plans through any of our local agencies, who will also assist them with the details of how to obtain passports, visas, etc.

*Steamships.*—The American Express Company represents all steamship lines and is therefore in a position to give unbiased information regarding any steamer or steamship company. We will assist your committee in selecting the official steamers. All offices will be prepared to assist in making reservations on both outward and return sailings.

*Hotel Accommodations.*—Our European organization will cooperate with your hotel and other committees in making plans for the entertainment of delegates.

*Postconvention Tours.*—We are submitting herewith four carefully selected itineraries suitable as postconvention tours. These are merely suggestions, and we would be pleased to revise them to meet the wishes of your committee. We hope that the selection will meet the requirements of every delegate. The costs of these trips are based on contract rate assuring the economy which is very apparent in organized movements.

*Organizing Groups.*—We will cooperate with dentists who are interested in organizing groups. Arrangements will first be subject to the approval of your Association. We hope that such arrangements will eliminate any deviation from the official plans.

*Special Representatives.*—The American Express Company will assign one of its representatives to the American Dental Association headquarters to handle all inquiries and requests for reservations, and relieve that office entirely of all details in connection with the Tours to the Paris Congress.

*Tour Leadership.*—The tour leader will sail from New York with your official party and will be at their service during the period of the Congress in Paris. Special conductors will be provided for each of the tours through Europe, and they, in turn, will be assisted by our local guides at all places visited.

We hope this matter will receive your favorable consideration.

Yours very truly,

E. L. WALSH, *Resident Manager.*

EIGHTH INTERNATIONAL DENTAL CONGRESS

TOUR ONE

| | |
|---|---|
| From New York to New York | $525.00 |
| From Montreal to Montreal | 490.00 |
| From New York to Montreal | 507.50 |
| From Montreal to New York | 507.50 |

Fri., July 24—Sail from New York at 10 a. m. on the S.S. *Caronia.* Minimum cabin-class allowance at the rate of $157.50 plus $5.00 U. S. tax and $2.75 French tax.

Sat., Aug. 1—Due Havre. Special boat-train to Paris.

or

Fri., July 24—Sail from Montreal at 10:00 a.m. on the S.S. *Aurania.* Minimum cabin-class at rate of $140.00 plus $5.00 U. S. tax and $2.75 French tax.

Sun., Aug. 2—Due Havre. Special boat-train to Paris.

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Sun., Aug. 2 to Sat., Aug. 8—*In Paris.* One day sightseeing program of the city, by motor coach, visiting grand boulevards, Champs Elysees, Arc de Triomphe, grave of the unknown soldier, tomb of Napoleon, Pantheon, Notre Dame, Hotel de Ville, Opera, Sainte Chapelle, site of the Bastille, etc.

By Saturday evening train to Brussels.

Sun., Aug. 9—*In Brussels.* One day tour through the capital city, visiting Palace de Brouchers, Bourse, Grand Palace, Hotel de Ville, Guild Houses, Palace of Justice, Church of Sts. Michel and Gudule, etc.

Mon., Aug. 10—To Amsterdam.

Mon., Aug. 10 and Tues., Aug. 11—*In Amsterdam.* Half-day motor coach tour of the city, visiting queen's palace, Rosengracht, National Museum and Tushinski, Rembrandt House, Waag, St. Nicholas Church, flower market, Jewish quarter, stock exchange, Dam Square. Half-day excursion to the Isle of Marken, returning by train.

Leave on the evening of the 11th via Hook of Holland and Harwich for London.

Wed., Aug. 12 to Fri., Aug. 14—*In London.* Two half-days sightseeing program by motor coach, visiting Thames Embankment, London Bridge, the Tower, Eastcheap, Cheapside, St. Paul's, Lincoln's Inn, Trafalgar Square, The Mall, Buckingham Palace, Hyde Park, Kensington Gardens, Westminster Abbey, Houses of Parliament.

One-day excursion by motor coach and Thames steamer to Windsor Castle, Hampton Court, Maidenhead and Stoke Poges.

Sat., Aug. 15—Train to Southampton. Sail for New York on the S.S. *Caronia.* Minimum cabin-class allowance at the rate of $152.50.

Mon., Aug. 24—Due New York.

or

Sat., Aug. 15—Train to Southampton. Sail for Montreal on the S.S. *Ausonia.* Minimum cabin-class allowance at the rate of $135.00.

Mon., Aug. 24—Due Montreal.

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TOUR TWO

From New York to New York.....$639.00
From Montreal to New York..... 621.50

Fri., July 24—Sail from New York at 10:00 a.m. on the S.S. *Caronia.* Minimum cabin-class allowance at the rate of $157.50 plus $5.00 U. S. tax and $2.75 French tax.

Sat., Aug. 1—Due Havre. Special boat-train to Paris.

or

Fri., July 24—Sail from Montreal at 10:00 a.m. on the S.S. *Aurania.* Minimum cabin-class at rate of $140.00 plus $5.00 U. S. tax and $2.75 French tax.

Sun., Aug. 2—Due Havre. Special boat-train to Paris.

Sun., Aug. 2 to Sat., Aug. 8—*In Paris.* One-day sightseeing program of the city by motor coach, visiting: grand boulevards, Champs Elysees, Arc de Triomphe, grave of the unknown soldier, tomb of Napoleon, Pantheon, Notre Dame, Hotel de Ville, Opera, Sainte Chapelle, site of Bastille, etc.

A full day excursion by motor coach to Versailles, the Trianon and Malmaison.

Sat., Aug. 8—Afternoon train via Dijon and Vallorbes to Montreux.

Sun., Aug. 9—*In Montreux.* Visit Castle of Chillon. Ascent to Glion.

Mon., Aug. 10—By rail through the picturesque Bernese Oberland to Interlaken.

Tues., Aug. 11—*In Interlaken.* A full day excursion by mountain railway to Lauterbrunnen, Scheidegg and Grindelwald.

Wed., Aug. 12—Morning train over the Brunig Pass to Lucerne. In the afternoon visit the old bridge, Glacier Garden, Lion of Lucerne monument, etc., on foot.

Thur., Aug. 13—Rail via Basle to Heidelberg, the old university city.

Fri., Aug. 14—*In Heidelberg.* Half-day motor coach drive, stopping at Scheffelhaus, Old Bridge, University Castle and other points of interest.

Sat., Aug. 15—Morning train to Mayence and by steamer down the Rhine to Cologne.

Sun., Aug. 16—*In Cologne.* Visit the famous cathedral. Afternoon train to Amsterdam.

Mon., Aug. 17 and Tues., Aug. 18—*In Amsterdam.* Half-day motor coach sightseeing program in the city, visiting Queen's Palace, Rosengracht, National Museum and Tuchinski, Rembrandt House, Waag, St. Nicholas Church, flower market, Jewish quarter, stock exchange, Dam Square and other points of interest.

Full-day excursion by water via Monnikendam, Edam, Volendam to the Isle of Marken.

Wed., Aug. 19—In the morning by electric train to The Hague. Afternoon motor coach sightseeing, including Scheveningen.

Thur., Aug. 20—Rail to Brussels. One half-day tour through the capital City, visiting: Palace de Brouchers, Bourse, Grand Palace, Hotel de Ville, Guild Houses, Palace of Justice, Church of St. Michel and Gudule, etc.

Fri., Aug. 21—Train to Antwerp and sail for New York on the S.S. *Lapland.* Minimum cabin-class allowance at the rate of $152.50.

Sun., Aug. 30—Due New York.
This tour returns to New York only.

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EXTENSION TO TOUR TWO

| | |
|---|---|
| From New York to New York | $754.00 |
| From Montreal to Montreal | 744.00 |
| From New York to Montreal | 761.50 |
| From Montreal to New York | 736.50 |

Sat., Aug. 21—Leave Brussels by the Channel route for London.

Sun., Aug. 22 to Wed., Aug. 26—*In London.* One-day sightseeing program of the city, visiting Thames Embankment, London Bridge, the Tower, Eastcheap, Cheapside, St. Paul's, Lincoln's Inn, Trafalgar Square, The Mall, Buckingham Palace, Hyde Park, Kensington Gardens, Westminster Abbey, Houses of Parliament. One-day excursion by motor coach and Thames steamer to Windsor Castle, Hampton Court, Maidenhead and Stoke Poges.

Thur., Aug. 27—Train to Oxford, where members will have an opportunity to visit the university and campus. Afternoon train to Leamington.

Fri., Aug. 28—*In Leamington.* Motor coach excursion through the Shakespeare Country with stops at Kenilworth, Warwick, Stratford-on-Avon, and Shottery.

Evening train to Liverpool.

Sat., Aug. 29—Embark and sail for New York on the S.S. *Baltic.* Minimum cabin-class allowance at the rate of $152.50.

Mon., Sept. 7—Due New York.

or

Fri., Aug. 28—Embark and sail for Montreal on the S.S. *Letitia.* Minimum cabin-class allowance at the rate of $135.00.

Sun., Sept. 6—Due Montreal.

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TOUR THREE

| | |
|---|---|
| From New York to New York | $632.00 |
| From Montreal to New York | 614.50 |

Fri., July 24—Sail from New York at 10:00 a.m. on the S.S. *Caronia.* Minimum cabin-class allowance at the rate of $157.50 plus $5.00 U. S. tax and $2.75 French tax.

Sat., Aug. 1—Due Havre. Special boat-train to Paris.

or

Fri., July 24—Sail from Montreal at 10:00 a.m. on the S.S. *Aurania.* Minimum cabin-class at rate of $140.00 plus $5.00 U. S. tax and $2.75 French tax.

Sun., Aug. 2—Due Havre. Special boat-train to Paris.

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Sun., Aug. 2 to Sat., Aug. 8—*In Paris.* One-day sightseeing program of the city by motor coach, visiting grand boulevards, Champs Elysees, Arc de Triomphe, grave of the unknown soldier, tomb of Napoleon, Pantheon, Notre Dame, Hotel de Ville, Opera, Sainte Chapelle, site of Bastille, etc.

By Saturday afternoon train via Dijon and Vallorbes to Montreux.

Sun., Aug. 9—*In Montreux.* Visit Castle of Chillon. Ascent to Glion.

Mon., Aug. 10—By rail through the picturesque Bernese Oberland to Interlaken.

Tues., Aug. 11—*In Interlaken.* A full-day excursion by mountain railway to Lauterbrunnen, Scheidegg and Grindelwald.

Wed., Aug. 12—Morning train over the Brunig Pass to Lucerne. In the afternoon, visit the Old Bridge, Glacier Garden, Lion of Lucerne monument, etc., on foot.

Thur., Aug. 13—Rail via Basle to Heidelberg, the old university city.

Fri., Aug. 14—*In Heidelberg.* Half-day motor coach drive, stopping at Scheffelhaus, Old Bridge, University Castle and other points of interest.

Sat., Aug. 15—Morning train to Mayence and by steamer down the Rhine to Cologne.

Sun., Aug. 16—*In Cologne.* Visit the famous cathedral.

Mon., Aug. 17—Rail to Berlin.

Tues., Aug. 18 to Thur., Aug. 20—*In Berlin.* A half-day sightseeing in the city, by motor coach, visiting Unter den Linden, Brandenburg Gate, state theater, Hedwig's Church, Royal Castle, the University, Charlottenburg Castle, town hall, Luther monument, and other points of interest. One full-day excursion by motor coach and launch through suburban Potsdam and to Sans Souci Palace, returning to Berlin via Wansee.

Fri., Aug. 21—Train to Hamburg.

Sat., Aug. 22—Embark in the evening for New York.

Sun., Aug. 23—Sail in the morning on the M.V. *St. Louis.* Minimum cabin-class allowance at the rate of $162.50.

Wed., Sept. 2—Due New York.

This tour returns to New York only.

OPTIONAL ROUTE VIA VIENNA IN CONNECTION WITH TOUR THREE

$15.00 additional

Thur., Aug. 13—Leave Tour Three at Lucerne and proceed by rail to Innsbruck in the Tyrol.

Fri., Aug. 14—By afternoon train to Vienna.

Sat., Aug. 15 and Sun., Aug. 16—*In Vienna.* A half-day sightseeing tour by motor coach, visiting Prater, Schoenbrunn Castle, Capucine vault, Ringstrasse, Coblenz Hill, Lichtenstine Castle.

Mon., Aug. 17—Rail to Berlin, joining Tour Three.

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TOUR FOUR

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|---|---|
| From New York to New York | $858.00 |
| From Montreal to Montreal | 823.00 |
| From New York to Montreal | 840.50 |
| From Montreal to New York | 840.50 |

Fri., July 24—Sail from New York at 10:00 a.m. on the S.S. *Caronia.* Minimum cabin-class allowance at the rate of $157.50 plus $5.00 U. S. tax and $2.75 French tax.

Sat., Aug. 1—Due Havre. Special boat-train to Paris.

**or**

Fri., July 24—Sail from Montreal at 10:00 a.m. on the S.S. *Aurania.* Minimum cabin-class at rate of $140.00 plus $5.00 U. S. tax and $2.75 French tax.

Sun., Aug. 2—Due Havre. Special boat-train to Paris.

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Sun., Aug. 2 to Sat., Aug. 8—*In Paris.* One-day sightseeing program of the city by motor coach, visiting grand boulevards, Champs Elysees, Arc de Triomphe, grave of the unknown soldier, tomb of Napoleon, Pantheon, Notre Dame, Hotel de Ville, Opera, Sainte Chapelle, site of Bastille, etc.

A full-day excursion by motor coach to Versailles, the Trianon and Malmaison.

By Saturday afternoon train via Dijon and Vallorbes to Montreux.

Sun., Aug. 9—*In Montreux.* Visit Castle of Chillon. Ascent to Glion.

Mon., Aug. 10 and Tues., Aug. 11—*In Interlaken.* A full-day excursion by mountain railway to Lauterbrunnen, Scheidegg and Grindelwald.

Wed., Aug. 12—Morning train over the Brunig Pass to Lucerne. In the afternoon, visit the Old Bridge, Glacier Garden, Lion of Lucerne monument, etc., on foot.

Thur., Aug. 13—Leave in the morning by lake steamer for Cluelen and by rail over the St. Gothard Route to Lugano.

Fri., Aug. 14—By steamer and electric train via Porlezza and Menaggio to Bellagio, one of the beauty spots of Italy.

Sat., Aug. 15—Morning steamer to Como and rail to Milan, where members will have an opportunity to see the cathedral and Santa Maria delle Grazie Church with Leonardo da Vinci's famous painting "The Last Supper."

By afternoon train to Venice.

Sun., Aug. 16 and Mon., Aug. 17—*In Venice.* Half-day sightseeing program by gondola and on foot, visiting Cathedral of San Marco, the famous Rialto Bridge, Ducal Palace, Campanile, Grand Canal, Bridge of Sighs, Ca'd'Oro, and other points of interest.

A half-day excursion to the Lido.

Tues., Aug. 18—Rail through the Apennines to Florence.

Wed., Aug. 19 and Thur., Aug. 20—*In Florence.* One-day sightseeing of the city covering a half-day drive by motor coach, visiting Palazzo Vecchio, Ponte Vecchio, the Church of San Lorenzo, Piazza della Signoria, the Medici Chapels, St. John Baptistry, the splendid cathedral, Dante's house, Fountain of Neptune and other points of interest, and a half-day visit to the Pitti and Uffizi Galleries on foot.

Fri., Aug. 21—Train to Rome.

Sat., Aug. 22 to Mon., Aug. 24—*In Rome.* Three half-days extensive sightseeing by motor coach, visiting Forum and Colosseum, Capitoline Hill, Mamertine Prison, St. Paul's Outside-the-Walls, St. Peter's, Trivi Fountain, Arch of Drusus, Temple of Vesta, Piazzi di Spagna, Victor Emmanuel monument, the Catacombs, etc.

Tues., Aug. 25—Train to Naples.

Wed., Aug. 26—*In Naples.* Half-day visit of the city, including Villa Nazionale Park, Squarium, Santa Lucia, Chiaia, Piazza di Martiri and national museum.

Thur., Aug. 27 and Fri., Aug. 28—A two-day excursion by motor to Pompeii, for a visit to the excavations and over the Amalfi Drive to Sorrento, where the night is spent. The next day, steamer to Capri for a visit of the Blue Grotto (weather permitting), returning by steamer to Naples.

Evening train to Rome.

Sat., Aug. 29—By rail via Pisa to Genoa.

Sun., Aug. 30—*In Genoa.* In the morning, passengers will have an opportunity to visit Columbus' birthplace and monument.

Noon train to Nice.

Mon., Aug. 31—*In Nice.* Motor coach excursion over the Grande Cornich Drive, returning to Nice via Monte Carlo.

Tues., Sept. 1—Rail to *Avignon.* In the afternoon, a visit to the Papal palaces and gardens afoot.

Wed., Sept. 2—Train to Paris.

Thur., Sept. 3 and Fri., Sept. 4—*In Paris.* Without prearranged [illegible].

Sat., Sept. 5—By boat-train to Havre and sail for New York on the S.S. *Lancastria.* Minimum cabin-class allowance at the rate of $155.00 plus $2.75 French tax.

Mon., Sept. 14—Due New York.

or

Sat., Sept. 5—By boat-train to Havre and sail for Montreal on the S.S. *Aurania.* Minimum cabin-class allowance at the rate of $140.00 plus $2.75 French tax.

Mon., Sept. 14—Due Montreal.

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OPTIONAL ROUTE VIA VIENNA IN CONNECTION WITH TOUR FOUR

$18.00 additional

Thur., Aug. 13—Leave Tour Four at Lucerne and proceed by rail to Innsbruck, in the Tyrol.

Fri., Aug. 14—By afternoon train to Vienna.

Sat., Aug. 15 and Sun., Aug. 16—*In Vienna.* A half-day sightseeing tour by motor coach, visiting Prater, Schoenbrunn Castle, Capucine vault, Ringstrasse, Coblenz Hill, Lichtenstein Castle.

Mon., Aug. 17—By rail to Venice.

Tues., Aug. 18—*In Venice.* Half-day sightseeing by gondola and on foot, visiting Cathedral of San Marco, the famous Rialto Bridge, Ducal Palace, Campanile, Grand Canal, Bridge of Sighs, Ca'd'Oro, etc.

Wed., Aug. 19—Rail through the Apennines to Florence.

Thur., Aug. 20—*In Florence.* One-day sightseeing of the city by motor coach, visiting Palazzo, Vecchio, Ponte Vecchio, the Church of San Lorenzo, Piazza della Signora, the Medici Chapels, St. John Baptistry, Dante's House, cathedral, etc.

Fri., Aug. 21—Proceed to Rome, joining Tour Four.

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GENERAL INFORMATION

*Registration.*—A deposit of $25 (returnable in full until one month before sailing date in case you cannot go), reserves a place on tour. Steamship accommodations will be protected in your name immediately. A further deposit representing 20 per cent of the cost of the tour is due May 1, 1931.

*Final Payment.*—Due June 24, 1931.

*Passports and Visas.*—Individuals must apply to the government for passports. These should then be signed and forwarded by registered mail to the American Express Company with a sum sufficient to pay for the desired visas, which will be procured for clients without service charge.

*Transportation*—Second class on the Continent, except in Italy, where first class is used, and the equivalent third class in Great Britain.

*Sightseeing.*—By motor coach or other local conveyances as specified in the itinerary.

*Hotels.*—Accommodations at first-class hotels. Two in a room without bath and three table d'hote meals per day except in Paris, where double rooms with bath and meat breakfast only will be included.

*Baggage.*—Steamer trunks, free for the ocean voyage, are to be shipped at client's expense from port of arrival to port of departure. A handbag and one suitcase approximately 10 by 15 by 24 inches will be carried free throughout the journey. Clients are urged to insure their baggage, and all American Express offices provide the facilities for doing so.

*Tour Manager.*—The American Express Company will furnish competent tour managers.

*Extras.*—Such expenses as are identical for all and calculable in advance are covered by the tour price. This includes regular tips to hotel, railway and local transportation employes, but not tips on the transatlantic liners, charges for extra food or refreshments or other strictly personal items.

*Possible Changes.*—If unavoidable circumstances necessitate any change of plan, this will be made in the interest of the party as a whole. Should service be cut down, refund will be made of the amount recoverable by us. If steamship sailings vary from schedule, any resultant saving will be refunded to clients and any additional expense will be borne by them.

*Withdrawals or Cancellations.*—If illness or other imperative reason compel a member's withdrawal after the tour begins, the company will refund all the actual saving it is able to effect; but there will be no refund on any absence of less than forty-eight hours. The tour manager's written acknowledgment should be obtained at the time and presented with claim to the New York office. Should the unfortunate necessity arise of requiring any individual to withdraw because detrimental to the party's welfare, a complete refund will be made covering the unfinished part of the tour, and this refund will be obtained as promptly as possible through the nearest office of the company.

*Responsibility.*—The American Express Company acts only as agents for the owners or contractors providing vehicles or transportation or other service, and all tickets are issued subject to any and all terms and conditions under which vehicles or transportation or any other services whatsoever are provided or which may be made by such owners or contractors; and the issuance and acceptance of such tickets shall be deemed to be consent to further condition that neither the American Express Company nor any affiliated or subsidiary company of the American Express System shall be or become liable or responsible in any way in connection with said vehicles or transportation or any other service whatsoever, or for any loss, injury or

damage to or in respect of any person or property howsoever caused or arising. The American Express Company assumes no responsibility for baggage, but the management will direct the shipment at "owner's risk" of baggage from place to place, and in the unlikely event of damage, delay or loss, it will do all reasonably within its power to lessen the hardship incurred. Those who wish to insure their baggage may do so through any of our offices.

*Travel Funds.*—For convenience, take American Express travelers checks. These are accepted in lieu of local currency throughout Europe, and a simple system of signing and counter-signing protects the holder in case of loss or theft.

### Hotels to Be Used on International Dental Congress Tours

The hotels to be used by members of the International Dental Congress tours will be the following, or similar to the following:

| | |
|---|---|
| Amsterdam | Victoria |
| Avignon | Dominion |
| Bellagio | Grand |
| Berlin | Central |
| Brussels | Palace |
| Cologne | Monopol-Metropol |
| Florence | Excelsior Italie |
| Genoa | Miramare |
| Heidelberg | Europaischerhof |
| Innsbruck | Europe |
| Interlaken | Victoria-Jungfrau |
| Leamington | Regent |
| London | Metropole |
| Lucerne | National |
| Lugano | Splendide |
| Montreux | Palace |
| Nice | Ruhl et des Anglais |
| Paris | D'Iena, Elysee Palace, Pierre Premier |
| Rome | Grand |
| Venice | Bauer Grunwald |
| Vienna | Grand, Bristol |

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BOX, H. K.
Necrotic gingivitis. Toronto, University of Toronto Press, 1930. $1.00

FELDMAN, M. H.
Manual of exodontia. Philadelphia, Lea & Febiger, 1930. $3.50

MAXIMOW, A. A., & BLOOM, WM.
Textbook of histology. Philadelphia, Saunders, 1930. $9.00

MCGEHEE, W. H. O.
Textbook of operative dentistry. Philadelphia, Blakiston, 1930. $10.00

MERRITT, A. H.
Periodontal diseases: diagnosis and treatment. New York, Macmillan, 1930. $4.00

NICHOLS, I. G.
Prosthetic dentistry: an encyclopedia of full and partial denture prosthesis. St. Louis, Mosby, 1930. $12.50

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Fundamental principles of alveolo-dental radiology. Brooklyn, Dental Items of Interest Pub. Co., 1930. $8.00

PRINZ, HERMANN
Dental formulary. Philadelphia, Lea & Febiger, 1930. $3.50

RAPP, F. W.
Elements of anatomical articulation or the mathematics of dental prosthetics. London, Bale, 1930. $1.25

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Dentistry—a profession and a business. Rochester, N. Y., Ritter Dental Mfg. Co., 1930. $7.50

ZEMSKY, J. L.
Oral diseases: practical treatise offering diagnostic and therapeutic aid to the practitioner of medicine and dentistry. Brooklyn, N. Y., Physicians and Surgeons Book Co., 1930. $8.00

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Outline of oral surgery. Brooklyn, N. Y., Physicians and Surgeons Book Co., 1930. $4.50

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